NASA

**Aerospace Medicine and Biology**
A Continuing Bibliography with Indexes

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# AEROSPACE MEDICINE AND BIOLOGY

## A CONTINUING BIBLIOGRAPHY WITH INDEXES

## (Supplement 302)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in September 1987 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

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# INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 131 reports, articles and other documents announced during September 1987 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA).* The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR,* including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1987 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

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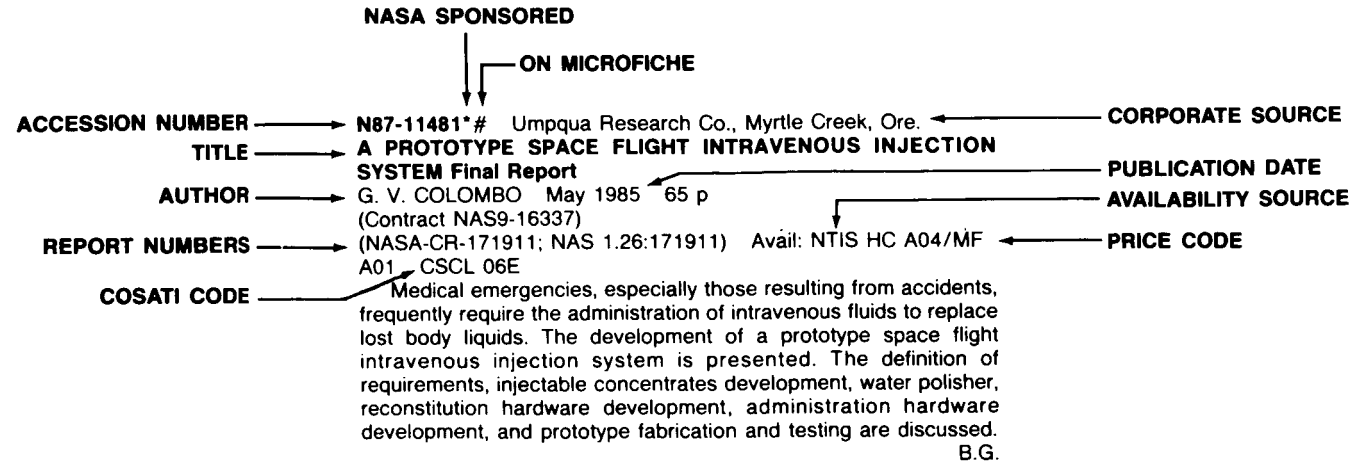
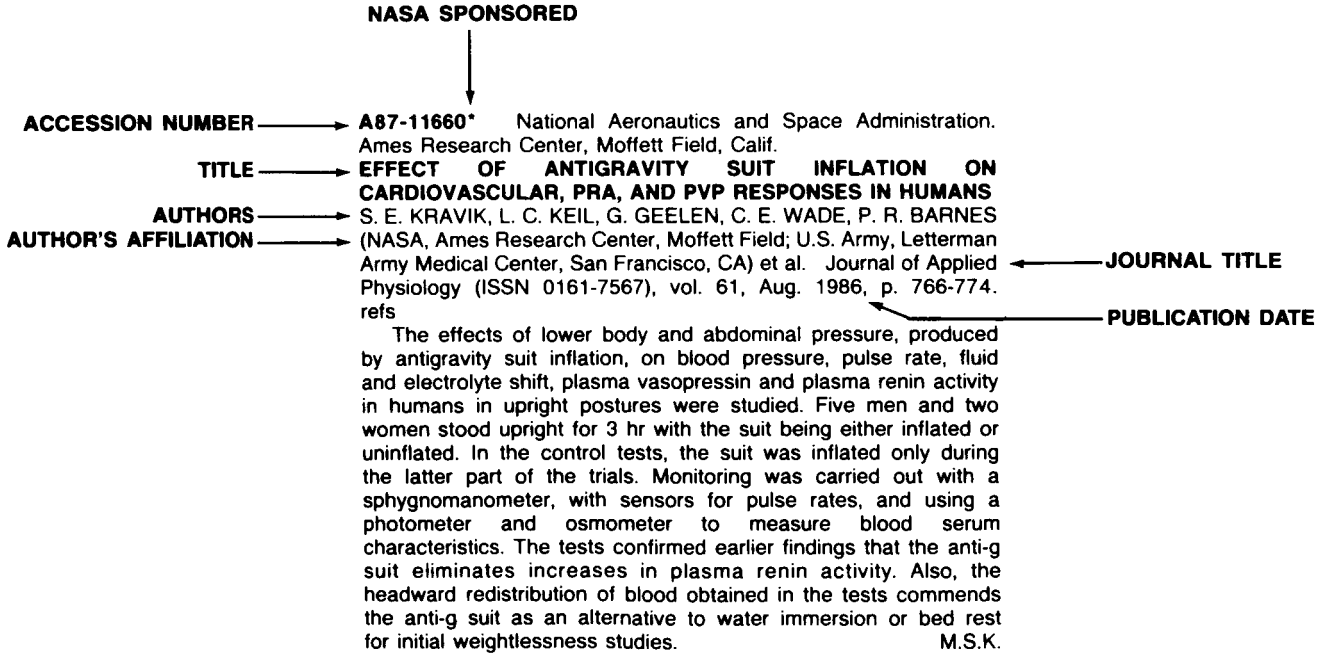
# TYPICAL REPORT CITATION AND ABSTRACT




# TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 302)*

OCTOBER 1987

## 51

## LIFE SCIENCES (GENERAL)

**A87-39525*#** Utah Univ., Salt Lake City.
**EFFECT OF 16, 16-DIMETHYL PROSTAGLANDIN E2 METHYL ESTER ON WEANLING RAT SKELETON - DAILY AND SYSTEMIC ADMINISTRATION**
YOSHIHISA FURUTA and WEBSTER S. S. JEE (Utah, University, Salt Lake City) Anatomical Record (ISSN 0003-276X), vol. 215, 1986, p. 305-316. refs
(Contract NIH-AM-20935; NIH-AM-27029; NAG2-108; DE-AC02-76EV-00119)

**A87-39837#**
**EXPERIMENT ON AGGREGATION OF RED CELLS UNDER MICROGRAVITY ON STS 51-C**
L. DINTENFASS, P. OSMAN, B. MAGUIRE, and H. JEDRZEJCZYK (Sydney, University; Rachel Foster Hospital, Redfern, Australia) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Material Sciences in Space - IV, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 6, no. 5, 1986, p. 81-84. refs

The kinetics of aggregation and the morphology of red blood cells under the conditions of microgravity were compared with the morphological and aggregation features seen on earth, using two specially designed slit-capillary photoviscometers, one situated on the Space Shuttle Discovery and the other in a ground laboratory, and identical blood samples. Blood donors included patients with myocardial infarction, insulin-dependent diabetes, hyperlipidemia, and hypertension. The blood samples were adjusted to the hematocrit of 0.30 using native plasma and were anticoagulated by EDTA. While the samples of all pathological cases exhibited severe red cell clumping and sludging on the ground, the morphology of aggregates of red cells formed in the same samples in space showed normal patterns. I.S.

**A87-40437#**
**DISTRIBUTION OF CONES IN HUMAN AND MONKEY RETINA - INDIVIDUAL VARIABILITY AND RADIAL ASYMMETRY**
CHRISTINE A. CURCIO, KENNETH R. SLOAN, JR., ORIN PACKER, ANITA E. HENDRICKSON, and ROBERT E. KALINA (Washington, University, Seattle) Science (ISSN 0036-8075), vol. 236, May 1, 1987, p. 579-582. Research supported by the Lions Sight Conservation Foundation of Washington-Northern Idaho. refs
(Contract NIH-EY-06109; NIH-EY-04536; NIH-EY-01208; NSF DCR-85-05713)

The distribution of photoreceptors is known for only one complete human retina and for the cardinal meridians only in the macaque monkey retina. Cones can be mapped in computer-reconstructed whole mounts of human and monkey retina. A 2.9-fold range in maximum cone density in the foveas of young adult humane eyes may contribute to individual differences in acuity. Cone distribution is radially asymmetrical about the fovea in both species, as previously described for the distribution of retinal ganglion cells and for lines of visual isosensitivity. Cone density was greater in the nasal than in the temporal peripheral retina, and this nasotemporal asymmetry was more pronounced in monkey than in human retina. Author

**A87-40636#**
**A NOVEL TYPE OF ENERGY METABOLISM INVOLVING FERMENTATION OF INORGANIC SULPHUR COMPOUNDS**
FRIEDHELM BAK and HERIBERT CYPIONKA (Konstanz, Universitaet, Constance, West Germany) Nature (ISSN 0028-0836), vol. 326, April 30, 1987, p. 891, 892. DFG-supported research. refs

A novel type of fermentation involving the disproportionation of inorganic sulfur compounds has been discovered in certain sulfate-reducing bacteria. The stoichiometry of fermentation engaged in by the bacterium, Desulfovibrio sulfodismutans, produces 0.75 mol sulfate and 0.25 mol sulfide per mol of sulfite; from thiosulfate, equal amounts of sulfate and sulfide are formed. The disproportionation of sulfite yields a free energy change of -58.9 kJ/mol per sulfite, the disproportionation of thiosulfate -21.9 kJ/mol. Thus, sulfite disproportionation will not allow for the conservation of more than 1 ATP molecule per sulfite molecule, and the disproportionation of thiosulfate even less. The finding of other bacteria which disproportionate inorganic sulfur compounds is reviewed. C.D.

**A87-40649*#** California Univ., La Jolla.
**GAMMA-GLUTAMYLCYSTEINE AND THIOSULFATE ARE THE MAJOR LOW-MOLECULAR-WEIGHTTHIOLS IN HALOBACTERIA**
GERALD L. NEWTON and BARBARA JAVOR (California, University, La Jolla) Journal of Bacteriology (ISSN 0021-9193), vol. 161, Jan. 1985, p. 438-441. Research supported by the Petroleum Research Fund. refs
(Contract NAGW-342; NSF PCM-81-16330)

Six representative species of extremely halophilic bacteria were found to contain approximately millimolar concentrations of gamma-glutamylcysteine in the absence of significant glutathione. Thiosulfate also accumulated in the halobacteria, apparently as a major product of cysteine oxidation. Author

**A87-40913#**
**AN ENVIRONMENTALLY-CONTROLLED EXTENDED-USE SMALL ANIMAL HYPOBARIC CHAMBER**
JAMES A. DEVINE and ALLEN CYMERMAN (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 473-476. refs

An environmentally-controlled extended-use hypobaric chamber has been designed to study small laboratory animals at low barometric pressures for long periods of exposure. The rectangular chamber (91.4 x 71.1 x 50.8 cm) is constructed of aluminum plate and acrylic resin with a volume of 330,000 cu cm. A computer/data acquisition control unit provides for controlling and collecting data on pressure, temperature, and relative humidity (RH). Altitude simulation is achieved using a two-stage, air-cooled vacuum pump. The pressure within the chamber is controlled by an incremental throttling valve in the vacuum line. Temperature control is accomplished by using a remote-controlled constant temperature circulating bath. RH is regulated by preconditioning the ventilation

purge air prior to entering the chamber. Acceptable levels of oxygen and carbon dioxide gases are maintained by purging with sufficient volumes of fresh air. Author

**A87-40945*#** Maryland Univ., Baltimore.
**GLUCOCORTICOID RECEPTOR-MEDIATED INDUCTION OF GLUTAMINE SYNTHETASE IN SKELETAL MUSCLE CELLS IN VITRO**
STEPHEN R. MAX, JOHN W. THOMAS, CARL BANNER, LJUBISA VITKOVIC, MASAAKI KONAGAYA (Maryland, University, Baltimore; NIH, National Institute of Neurological and Communicative Diseases et al. Endocrinology (ISSN 0013-7227), vol. 120, no. 4, 1987, p. 1-5. refs
(Contract NAG2-100; NIH-HD-16596)

The regulation by glucocorticoids of glutamine synthetase in L6 muscle cells in culture is studied. Glutamine synthetase activity was strikingly enhanced by dexamethasone. The dexamethasone-mediated induction of glutamine synthetase activity was blocked by RU38486, a glucocorticoid antagonist, indicating the involvement of intracellular glucocorticoid receptors in the induction process. RU38486 alone was without efffect. Northern blot analysis revealed that dexamethasone-mediated enhancement of glutamine synthetase activity involves increased levels of glutamine synthetase mRNA. Glucocorticoids regulate the expression of glutamine synthetase mRNA in cultured muscle cells via interaction with intracellular receptors. Such regulation may be relevant to control of glutamine production by muscle. Author

**A87-40965#**
**SPECIFIC INTERACTIONS OF DINUCLEOSIDE MONOPHOSPHATES WITH THEIR COGNATE AMINO ACIDS**
MIKIO SHIMIZU (Tokyo, University, Japan) Physical Society of Japan, Journal (ISSN 0031-9015), vol. 56, Jan. 1987, p. 43-45. refs

Specific interactions of anticodonic dinucleoside monophosphates and their cognate amino acids have been detected by using a precise ultraviolet difference absorbance photometry. The affinity coefficients are of the order of 1/M, similar to those in the base-base stacking interactions, suggesting the lock and key relationship for the above interaction. All signals are hyperchromic and may be caused by destacking of the dinucleoside monophosphate due to the above complex formation. Author

**A87-41150*#** California Univ., La Jolla.
**OCCURRENCE OF LOW MOLECULAR WEIGHT THIOLS IN BIOLOGICAL SYSTEMS**
ROBERT C. FAHEY and GERALD L. NEWTON (California, University, La Jolla) IN: Functions of glutathione: Biochemical, physiological, toxicological, and clinical aspects. New York, Raven Press, 1983, p. 251-260. refs
(Contract NIH-GM-22122; NAGW-342)

Bromobimane labeling and high performance chromatography analysis were applied to various species of bacteria, plant tissues, and animal tissues. The reaction between thiols and monobromobimane is studied. Chromatograms revealing peaks produced by nonthiols and thiols are analyzed and compared. It is observed that all the bacteria species contain hydrogen sulfide, and glutathione is contained in facultative and aerobic gram-negative bacteria. For the plant tissues, the data reveal that mung bean sprouts contain homoglutathione and no glutathione; alfalfa sprouts contain homoglutathione and glutathione; the pea seed, nonlegumes, and fungi contain glutathione and no homoglutathione. It is detected that the main thiol in the animal tissues is glutathione. Based on the data, it is suggested that glutathione has an essential function in higher organisms. I.F.

**A87-41548#**
**ISOLATION OF EXTREMELY THERMOPHILIC SULFATE REDUCERS - EVIDENCE FOR A NOVEL BRANCH OF ARCHAEBACTERIA**
KARL O. STETTER, GERTA LAUERER, MICHAEL THOMM, and ANNEMARIE NEUNER (Regensburg, Universitaet, West Germany) Science (ISSN 0036-8075), vol. 236, May 15, 1987, p. 822-824. Research supported by the Fonds der Chemischen Industrie. refs
(Contract DFG-SFB-43)

Extremely thermophilic archaebacteria are known to be metabolizers of elemental sulfur and the methanogens. A novel group of extremely thermophilic archaebacteria is described, which consists of sulfate-respiring organisms that contain pure factor 420 and that have been isolated from marine hydrothermal systems in Italy. They possess a third type of archaebacterial RNA polymerase structure previously unknown, indicating an exceptional phylogenetic position. Most likely, this group represents a third major branch within the archaebacteria. The existence of sulfate reducers at extremely high temperatures could explain hydrogen sulfide formation in hot sulfate-containing environments, such as submarine hydrothermal systems and deep oil wells. Author

**A87-41671#**
**MOLECULAR MECHANISMS OF PHOTOSYNTHESIS**
DOUGLAS C. YOUVAN (MIT, Cambridge, MA) and BARRY L. MARRS (Du Pont de Nemours and Co., Inc., Wilmington, DE) Scientific American (ISSN 0036-8733), vol. 256, June 1987, p. 42-48.

The results of spectroscopic, X-ray crystallography and photosynthesis studies of the molecular bases of photosynthesis are discussed for the case of photosynthetic bacteria of the genus Rhodopseudomonas, which do not generate oxygen gas as the higher plants do. Attention is given to the sequence and timing of the electron-transfer reactions occurring in the photosynthetic reaction center after its absorption of a photon, and to the structure of complex biological molecules at the atomic scale. The quinone molecule that ultimately receives the electrons in rhodopseudomonads functions in a very similar way to that of higher plants. O.C.

**A87-41673#**
**THE ANATOMY OF MEMORY**
MORTIMER MISHKIN (NIH, National Institute of Mental Health, Bethesda, MD) and TIM APPENZELLER Scientific American (ISSN 0036-8733), vol. 256, June 1987, p. 80-89.

An assessment is made of experimental studies on macaque monkeys that combine investigations of anatomical, physiological and behavioral phenomena implicated in the functioning of memory-related processes. Tracers carried along axons, through which neurons send signals, have revealed the neural circuitry allowing specific structures to play a role in memory, while measurements of the electrical activity of neurons have distinguished the parts of the brain that are active during tasks related to learning. The combination of surgery or drug administration with psychological testing has led to the assessment of the functional importance of structures identified by other means. O.C.

**A87-41726#**
**FUNCTIONAL MAPPING OF THE BRAIN [FUNKTSIONAL'NOE KARTIROVANIE MOZGA]**
I. A. SHEVELEV (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii, Moscow, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 18, Apr.-June 1987, p. 16-36. In Russian. refs

Methods used for mapping the cerebral functions are described with special attention given to the methods of neurovisualization. These methods include the techniques of isotope clearance, use of potential-dependent dyes, nuclear magnetic resonance tomography, positron-emisssion tomography, glucose-labeling, and noninvasive thermoencephaloscopy. The latter method is given

special consideration. The sensitivity, resolving power, invasiveness, and cost of these methods are compared. I.S.

**A87-41727#**
**MUSCLE EFFICIENCY AND THE COMPONENTS OF THE ENERGY EXPENDITURE IN MUSCLES [KOEFFITSIENT POLEZNOGO DEISTVIIA MYSHTS I SOSTAVLIAIUSHCHIE RASKHODA ENERGII V MYSHTSAKH]**
IU. S. ALIUKHIN (AN SSSR, Institut Fiziologii, Leningrad, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 18, Apr.-June 1987, p. 98-113. In Russian. refs

The meaning of the concept of muscle efficiency (ME) is examined. It is noted that ME can be classified into 'types' such as the mechanical and thermodynamic ME, the overall ME and the ME of contractions, or the initial ME and the ME of a full energetic cycle. These distinctions are based on the fact that during short isotonic contractions under small load there is a nonproportional relationship between the muscle work and the expenditure of energy. The relationships between the work and the energy expense are considered for various types of ME calculations, with special attention given to variations of ME with mechanical, physical, and biological conditions. While the maximal ME for a full energy cycle in the cardiac and skeletal muscles is between 0.35 and 0.40, the initial ME is considered to be close to 0.7-0.8. It is suggested, on the basis of the data analyzed, that the ME is regulated physiologically. I.S.

**A87-41764#**
**MORPHOFUNCTIONAL DIFFERENCES AT TISSUE LEVEL BETWEEN SOME RODENTS OF THE ARID ZONE, COMMON VOLE, AND LABORATORY MOUSE S57V1 DIFFERING IN RADIORESISTANCE [MORFO-FUNKTSIONAL'NYE RAZLICHIIA NA TKANEVOM UROVNE U NEKOTORYKH GRYZUNOV ARIDNOI ZONY, POLEVKI OBYKNOVENNOI I LABORATORNOI MYSHI S57VI, OTLICHAIUSHCHIKHSIA PO RADIOUSTOICHIVOSTI]**
M. F. POPOVA and N. V. BULIAKOVA (AN SSSR, Institut Evoliutsionnoi Morfologii i Ekologii Zhivotnykh, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 293, no. 2, 1987, p. 456-458. In Russian. refs

**A87-41765#**
**METHANOHALOBIUM EVESTIGATUS N.GEN., N.SP. - AN EXTREMELY HALOPHILIC METHANE-FORMING ARCHEBACTERIUM [METHANOHALOBIUM EVESTIGATUS N.GEN., N.SP. - EKSTREMAL'NO-GALOFIL'NAIA METANOOBRAZUIUSHCHAIA ARKHEBAKTERIIA]**
I. N. ZHILINA and G. A. ZAVARZIN (AN SSSR, Institut Mikrobiologii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 293, no. 2, 1987, p. 464-468. In Russian. refs

A new methane-forming microorganism, discovered in the salt lakes of the Crimea, is described which develops at salt concentrations up to 30 percent and forms methane from methylamines. In view of the extreme halophylism, characteristic of a branch of archebacteria, combined with the fact that methanogenesis provides the only way of energy generation, the microorganism is classified under a high taxonomic category. Details of the growth and a brief characterization of the bacterium are presented. T.K.

**A87-41766#**
**PREVENTION AND ELIMINATION OF CARDIAC ARRHYTHMIAS BY ADAPTATION TO THE PERIODIC ACTION OF HIGH-ALTITUDE HYPOXIA [PREDUPREZHDENIE I USTRANENIE SERDECHNYKH ARITMII S POMOSHCH'IU ADAPTATSII K PERIODICHESKOMU DEISTVIIU VYSOTNOI GIPOKSII]**
F. Z. MEERSON, E. E. USTINOVA, and E. V. SHABUNINA (AMN, Nauchno-Issledovatel'skii Institut Obshchei Patologii i Fiziologii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 293, no. 2, 1987, p. 489-492. In Russian. refs

**A87-41767#**
**INCREASING THE NONSPECIFIC RESISTANCE OF THE ORGANISM BY MEANS OF NORMOBARIC HYPOXIC STIMULATION [POVYSHENIE NESPETSIFICHESKOI REZISTENTNOSTI ORGANIZMA S POMOSHCH'IU NORMOBARICHESKOI GIPOKSICHESKOI STIMULIATSII]**
R. B. STRELKOV, IU. M. KARASH, A. IA. CHIZHOV, I. IU. KIR'IANOV, A. G. BELYKH (II Moskovskii Gosudarstvennyi Meditsinskii Institut; Vsesoiuznyi Nauchno-Issledovatel'skii Tsentr p et al. Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 293, no. 2, 1987, p. 493-496. In Russian. refs

**A87-41799#**
**METAL COMPOUNDS IN PLANTS IN THE EVOLUTION OF THE AEROBIC BIOSPHERE [SOEDINENIIA METALLOV U RASTENII V EVOLIUTSII AEROBNOI BIOSFERY]**
E. A. BOICHENKO (AN SSSR, Institut Geokhimii i Analiticheskoi Khimii, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia (ISSN 0002-3329), Mar.-Apr. 1987, p. 237-244. In Russian. refs

Changes in the distributions of Fe and Mn in cells and in cellular components of lower and higher plants, which accompanied the gradual increase (during evolution of the biosphere) in atmospheric oxygen and which could be traced to different eras, are examined. It is shown that in the course of evolution there was a steady decrease in the contents of cellular Fe (from 0.3050 wt pct in blue-green algae to 0.0173 wt pct in angiosperms), accompanied by an increase in the content of Mn (from 0.0031 to 0.0112 in the respective plant groups), with particularly dramatic increases of lipid-fraction Mn. At the same time, the Fe/Mn ratio in the chloroplastic CO2 reductases decreased steadily. These changes reflect the appearance of phototrophic metabolism in the biosphere history and its progressive evolution. I.S.

**A87-41800#**
**THE EFFECT OF PULSED MICROWAVE RADIATION ON THE NEURONAL ELECTRICAL ACTIVITY IN MOLLUSKS [VLIIANIE IMPUL'SNOGO MIKROVOLNOVOGO OBLUCHENIIA NA ELECTRICHESKUIU AKTIVNOST' NEIRONOV MOLLIUSKOV]**
M. A. BOL'SHAKOV and S. I. ALEKSEEV (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino, USSR) Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia (ISSN 0002-3329), Mar.-Apr. 1987, p. 312-314. In Russian. refs

The effect of irradiation by microwaves pulse-modulated at 16 and 100 Hz on the activity of the large parietal ganglion of Lymnaea stagnalis was studied by measuring the electrical activity of individual neurons before, during, and after irradiation. It was found that for 16-Hz modulation and an SAR of 0.5 W/kg, the neuronal activity during the 10 min of radiation was inhibited. For an SAR of 2 W/kg, the microwave effect was more complex: the discharge rates were inhibited in about 30 percent of the neurons, but were increased in the rest. Upon exposure to 100-Hz modulation, no significant changes were observed at an SAR of 0.5 W/kg; at an SAR of 2 W/kg, the activity increased in all neurons. It is argued that the reactions at 2 W/kg may be connected with the heating effect of the microwaves. The mechanism of discharge inhibition at low SAR (and 16-Hz frequency) is not clear. I.S.

**A87-41806#**
**HEAT TRANSFER BY BLOOD [O PERENOSE TEPLA KROV'IU]**
I. I. ERMAKOVA (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) and K. P. IVANOV (AN SSSR, Institut Fiziologii, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 103-108. In Russian. refs

The efficiency of blood-mediated heat transfer from the brain was analyzed using data on neuronal heat transfer in the stationary state obtained in animals. The computations account for heat generation, heat conduction to the skin, circulation volume, and for the thermal properties of blood. The results indicated that the conduction of heat from the brain occurs with only minimal (0.25 C) temperature increase in venous blood. It was also shown that a significant increase of heat production by internal organs can

be compensated by only a small increase of skin blood flow. I.S.

**A87-41831#**
**THE STATE OF THE BLOOD-BRAIN BARRIER EXPOSED TO RADIATION UNDER CONDITIONS OF HYPOXIA AND HYPEROXIA [SOSTOIANIE GEMATOENTSEFALICHESKOGO BAR'ERA PRI OBLUCHENII V USLOVIIAKH GIPO- I GIPEROKSII]**
V. P. FEDOROV (Voronezhskii Gosudarstvennyi Meditsinskii Institut, Voronezh, USSR) and I. B. USHAKOV (MZ SSSR, Institut Biofiziki, Moscow, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Mar.-Apr. 1987, p. 182-188. In Russian. refs

Morphological, enzymatic, and hydration changes effected in the blood-brain barrier (BBB) of animals exposed to ionizing radiation under conditions of hyperoxia or hypoxia were studied in rats and dogs sacrificed at 0.1, 1.7, 5, 24, and 72 h after exposure. The BBB status was shown to change depending upon the radiation dose and the time after exposure. Hypoxia, as opposed to conditions of air breathing and hyperoxia, had a slight radioprotective effect. However, in animals exposed to superlethal doses in different atmospheric conditions, no variations were found 5 hours after radiation. I.S.

**A87-41832#**
**LETHAL EFFECT OF ACCELERATED HEAVY IONS ON MAMMALIAN CELLS UNDER THE EFFECT OF INHIBITORS OF DNA SYNTHESIS - THEORETICAL STUDY [LETAL'NOE DEISTVIE USKORENNYKH TIAZHELYKH IONOV NA KLETKI MLEKOPITAIUSHCHIKH V USLOVIIAKH VLIIANIIA INGIBITOROV SINTEZA DNK - TEORETICHESKII ANALIZ]**
S. KOZUBEK, E. A. KRASAVIN, R. D. GOVORUN, and E. A. NASONOVA (Ob'edinennyi Institut Iadernykh Issledovanii, Dubna, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Mar.-Apr. 1987, p. 212-217. In Russian. refs

**A87-41833#**
**THE EFFECT OF CHRONIC EXPOSURE TO GAMMA-RADIATION ON THE ACTIVITY OF DEHYDROGENASE IN TISSUES OF MICROTUS OECONOMUS AND THEIR DESCENDANTS LIVING IN CONDITIONS OF ELEVATED RADIOACTIVITY [VLIIANIE KHRONICHESKOGO GAMMA-OBLUCHENIIA NA AKTIVNOST' DEGIDROGENAZ V TKANIAKH POLEVOK-EKONOMOK I IKH POTOMSTVA, OBITAIUSHCHIKH V USLOVIIAKH POVYSHENNOI RADIOAKTIVNOSTI]**
A. T. PIKULEV, A. G. KUDIASHEVA, and A. I. TASKAEV (AN SSSR, Institut Biologii, Syktyvkar, USSR; Belorusskii Gosudarstvennyi Universitet, Minsk, Beloru Radiobiologiia (ISSN 0033-8192), vol. 27, Mar.-Apr. 1987, p. 218-223. In Russian. refs

**A87-41834#**
**THE EFFECT OF RADIOMODIFIERS ON LIPID PEROXIDATION AND ON THE STRUCTURE AND FUNCTIONS OF IRRADIATED MITOCHONDRIA [VLIIANIE RADIOMODIFIKATOROV NA PEREKISNOE OKISLENIE LIPIDOV I STRUKTURNO-FUNKTSIONAL'NOE SOSTOIANIE OBLUCHENNYKH MITOKHONDRII]**
A. S. SEILANOV, V. V. KONEV, and G. A. POPOV (Nauchno-Issledovatel'skii Institut Meditsinskoi Radiologii, Obninsk, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Mar.-Apr. 1987, p. 242-245. In Russian. refs

**A87-41835#**
**CYTOPHOTOMETRY OF MYELOCARYOCYTE DNA AFTER A SINGLE EXPOSURE TO LOW-INTENSITY MICROWAVES [TSITOFOTOMETRIIA DNK MIELOKARIOTSITOV POSLE ODNOKRATNOGO DEISTVIIA SVCH-OBLUCHENIIA MALOI INTENSIVNOSTI]**
E. I. OBUKHAN and M. I. RUDNEV (Kievskii Nauchno-Issledovatel'skii Institut Obshchei i Kommunal'noi Gigieny, Kiev, Ukrainian SSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Mar.-Apr. 1987, p. 264-266. In Russian. refs

The effect of a single whole-body exposure to microwave radiation (2375 MHz for 7 h) on the mitosis and DNA content of myelocaryocytes in rats was investigated using cytological and cytophotometric techniques for periodic postexposure examinations. It was found that, twelve hours after the exposure, the values of the mitotic index (MI) of lymphoid cells decreased (to 0.32 compared with 1.29 in nonirradiated controls), while the contents of the interphase-stage DNA in the nondifferentiated, blast, and lymphoid cells increased. At the same time, the number of cells found in the postsynthetic phase and their DNA contents decreased. One week after the exposure these characteristics returned to control levels. It is argued that the observed changes reflect the short-term adaptive reactions of the blood system which resulted in increased synthetic activity in mature cells and in suppression of proliferative activity in nondifferentiated cells. I.S.

**N87-24062#** Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
**PROCEEDINGS OF THE TENTH DOE SOLAR PHOTOCHEMISTRY RESEARCH CONFERENCE**
1986 245 p Conference held in Ontario, Canada, 8 Jun. 1986 Prepared in cooperation with Windsor Univ., Ontario
(Contract DE-AC02-83CH-10093)
(DE87-006421; SERI/CP-233-2959; CONF-8606279) Avail: NTIS HC A11/MF A01

The Tenth DOE Solar Photochemistry Research conference cosponsored by the Division of Chemical Sciences, Office of Basic Energy Sciences, US Department of Energy and the Natural Sciences and Engineering Research Council of Canada was held on June 8-12, 1986, at the Pillar and Post Conference Center in Niagara-on-the-Lake, Ontario, Canada. This volume contains the program of the meeting, the abstracts of 29 formal presentations and 46 posters. In commemoration of the 10th anniversary of this conference, a special session was held in which James R. Bolton of the University of Western Ontario presented an overview of past accomplishments and served as moderator for a panel comprised of Melvin Calvin, Nick Serpone, Michael Wasielewski and Mark Wrighton, who discussed future directions of solar photochemical conversion research. A transcript of these proceedings is included in this volume. DOE

**N87-24063*#** National Aeronautics and Space Administration, Washington, D.C.
**THE 1986-87 NASA SPACE/GRAVITATIONAL BIOLOGY ACCOMPLISHMENTS**
THORA W. HALSTEAD, ed. Jun. 1987 223 p Prepared in cooperation with George Washington Univ., Washington, D.C.
(Contract NASW-3165)
(NASA-TM-89951; NAS 1.15:89951) Avail: NTIS HC A10/MF A01 CSCL 06B

This report consists of individual technical summaries of research projects of NASA's Space/Gravitational Biology program, for research conducted during the period January 1986 to April 1987. This program utilizes the unique characteristics of the space environment, particularly microgravity, as a tool to advance knowledge in the biological sciences; understanding how gravity has shaped and affected life on Earth; and understanding how the space environment affects both plant and animal species. The summaries for each project include a description of the research, a list of accomplishments, an explanation of the significance of the accomplishments, and a list of publications. Author

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# AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

**N87-24064*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**HUMAN FACTORS IN SPACE STATION ARCHITECTURE 2. EVA ACCESS FACILITY: A COMPARATIVE ANALYSIS OF 4 CONCEPTS FOR ON-ORBIT SPACE SUIT SERVICING**

MARC M. COHEN and STEVEN BUSSOLARI (Massachusetts Inst. of Tech., Cambridge.) Apr. 1987 25 p

(NASA-TM-86856; A-86037; NAS 1.15:86856) Avail: NTIS HC A02/MF A01 CSCL 05H

Four concepts for on-orbit spacesuit donning, doffing, servicing, check-out, egress and ingress are presented. These are: the Space Transportation System (STS) Type (shuttle system enlarged), the Transit Airlock (Shuttle Airlock with suit servicing removed from the pump-down chamber), the Suitport (a rear-entry suit mates to a port in the airlock wall), and the Crewlock (a small, individual, conformal airlock). Each of these four concepts is compared through a series of seven steps representing a typical Extra Vehicular Activity (EVA) mission: (1) Predonning suit preparation; (2) Portable Life Support System (PLSS) preparation; (3) Suit Donning and Final Check; (4) Egress/Ingress; (5) Mid-EVA rest period; (6) Post-EVA Securing; (7) Non-Routine Maintenance. The different characteristics of each concept are articulated through this step-by-step approach. Recommendations concerning an approach for further evaluations of airlock geometry, anthropometrics, ergonomics, and functional efficiency are made. The key recommendation is that before any particular airlock can be designed, the full range of spacesuit servicing functions must be considered, including timelines that are most supportive of EVA human productivity. Author

**N87-24872#** Chemical Research and Development Center, Aberdeen Proving Ground, Md.

**THERMOPHILIC AND HALOPHILIC ENZYMES Technical Report, Jun. 1984 - Jan. 1986**

KENNETH MIODUSKI and WILLIAM E. WHITE Feb. 1987 23 p

(AD-A179058; CRDEC-TR-87029) Avail: NTIS HC A02/MF A01 CSCL 06A

Some species of microorganisms survive under heat and saline conditions that would denature the proteins of less tolerant counterparts. In this report, we analyze numerous small changes in a class of proteins from thermophilic and halophilic bacteria to elucidate the biochemical traits that confer stability. Major advances in chemical-biological detection and contamination control depend on the proper functioning of proteins such as antibodies, enzymes, and receptor sites. If protein-based detectors and decontaminants are to reach the soldier in the field, the biomolecules will have to be heat- and salt-tolerant. Knowledge of how naturally resistant molecules achieve their stability will enable biotechnologists to introduce precise stabilizing characteristics into needed, but otherwise fragile, proteins. GRA

**A87-40298*#** Uniformed Services Univ. of the Health Sciences, Bethesda, Md.

**EFFECTS OF EXERCISE AND CONDITIONING ON CLOTTING AND FIBRINOLYTIC ACTIVITY IN MEN**

EARL W. FERGUSON, LANI L. BERNIER, GUY R. BANTA, JANET YU-YAHIRO, and ERIC B. SCHOOMAKER (Uniformed Services University of Health Sciences, Bethesda, MD) Journal of Applied Physiology (ISSN 0161-7567), vol. 62, April 1987, p. 1416-1421. Research supported by the Uniformed Services University of Health Sciences. refs

(Contract NASA ORDER T-5043-J)

Blood clotting and fibrinolytic activity in three groups of nonsmoking, nonobese, healthy men ranging from 19 to 59 years are studied. The groups consisted of (1) marathoners (men running more than 50 miles/week); (2) joggers (men running 5-15 miles/week; and (3) sedentary subjects (men who did not exercise routinely). It is observed that the rate of blood clotting is accelerated by exercise; marathoners had greater increases in fibrinolytic activity than the other two groups; and fibrin degradation products increased with exercise. The data reveal that the changes in clotting assays with exercise do not correlate with changes in whole blood lactate, blood pyruvate, or rectal temperatures. It is noted that the level of acceleration for fibrinolytic activity is directly related to the maximum aerobic capacity and work load of the individual, and that conditioning enhances the fibrinolytic response to exercise. I.F.

**A87-40383#**

**SCREENING FOR HEART DISEASE IN PILOTS - IS TREADMILL EXERCISE AN ANSWER?**

A. T. WIELGOSZ (Ottawa General Hospital, Canada) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 32, Sept. 1986, p. 214-217. refs

Fatal accidents due to pilot incapacitation, associated with acute coronary ischemia, inevitably lead to a re-examination of means to prevent such occurrences. Routine screening of all pilots with a treadmill exercise test is strongly advocated by some as a means of identifying those at risk for sudden cardiac incapacitation. Unless pilots withhold information about symptoms, such screening would apply to an asymptomatic population. It can be shown that such a policy will yield a higher number of false positive cases then true positive ones. A significant number of pilots then will require further investigations while enduring the consequences of diagnostic labelling. It can be demonstrated by analytic techniques that selective screening, based on the presence of specific risk factors and the use of test end-points with a high sensitivity for predicting coronary artery disease, will provide a better yield. A rational policy towards screening pilots for the presence of significant coronary artery disease is advocated. Author

**A87-40524#**

**LOCOMOTIVE RHYTHMS - ORIGIN AND CERTAIN POSSIBILITIES OF APPLICATION [RYTMY LOKOMOCYJNE - GENEZA I NIEKTORE MOZLIWOSCI PRAKTYCZNEGO WYKORZYSTANIA]**

JANUSZ M. MORAWSKI Instytut Lotnictwa, Prace (ISSN 0509-6669), no. 104-105, 1986, p. 121-135. In Polish. refs

**A87-40560#**
**PROBLEMS IN AEROMEDICAL EVALUATION. III - 'NON-SPECIFIC' REPOLARISATION ECG ABNORMALITIES**
K. V. S. MANI (Indian Air Force Hospital, Kanpur, India), N. RATTAN (Indian Air Force, Air Force Central Medical Establishment, New Delhi, India), and A. S. KASTURI (Indian Air Force, Command Hospital, Poona, India) Aviation Medicine, vol. 29, Dec. 1985, p. 85-89. refs

A retrospective study of the routine ECGs carried out on 8922 males (age 20-55 yr) during 1973-1983 was undertaken. Out of them, 274 asymptomatic subjects (mean age 37 yr) were detected to have repolarization (S-T, T and S-T/T) abnormalities. However, they did not fulfill the criteria for coronary artery disease (CAD) even after stress-testing and were therefore considered 'non-specific' repolarization ECG abnormalities (test group). When followed-up (mean period 4.2 yr), 66/274 (24 percent) were found to subsequently develop changes specific for CAD, as against 177 (2.0 percent) in the rest of 8648. This is statistically highly significant. Within the test group, presence of one or more coronary risk factors amongst 60 percent (40/66) of them was also significant in subsequent development of CAD. Author

**A87-40561#**
**AN ANALYSIS OF NON SPECIFIC ECG ABNORMALITIES AMONGST INDIAN AIR FORCE OFFICERS**
N. RATTAN (Indian Air Force, Air Force Station, Halware, India) Aviation Medicine, vol. 29, Dec. 1985, p. 90-99. refs

A retrospective study of ECG abnormalities amonst IAF Officers was undertaken. A total of 403 cases were studied. T wave abnormalities were the most common findings, and they have a tendency to regress with exercise. Most of the abnormalities relate to inferior wall. T and ST abnormalities are statistically related to an increased risk to develop ischemic heart disease. Nonspecific ECG abnormalities could be early indicators of myocardial ischemia. A systematic approach to cardiovascular evaluation of an individual with ECG abnormality is recommended. Author

**A87-40562#**
**AMBULATORY MONITORING IN EVALUATION OF CARDIOVASCULAR PROBLEMS - OUR EXPERIENCE AT IAM, BANGALORE**
S. N. SHARMA (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), J. S. KULKARNI, M. M. SINGH, V. M. ALURKAR (Indian Air Force, Command Hospital, Bangalore, India), R. K. GANJOO (Indian Air Force Central Medical Establishment, New Delhi, India) et al. Aviation Medicine, vol. 29, Dec. 1985, p. 100-103. refs

This paper presents experience with ambulatory monitoring in evaluation of CVS problems. A total of 115 IAF officers were studied at IAM with twenty-four hours ambulatory monitoring, using portable cardiodyne cardiocassette-type records. Definite diagnosis could be arrived at in 50 cases, and cardiac disorders were excluded in 48 cases. Ambulatory monitoring as a procedure for diagnosis, management, and disposal of CVS cases is recommended. Author

**A87-40563#**
**ROLE OF AVIATION MEDICINE SPECIALIST IN COMMERCIAL AIRLINES**
R. R. KAPUR (Indian Air Force, Institute of Aviation Medicine, Bangalore, India) Aviation Medicine, vol. 29, Dec. 1985, p. 104-108.

The areas where the role of an aviation medical specialist in commercial airlines is essential are discussed. These include the processes of selection and maintenance of the crew; their indoctrination in the subjects of aviation medicine and aircrew first aid; and advising airline management on the subjects of aircrew fatigue, time zone changes, and crew duty scheduling. Consideration is given to the acceptance and inflight care of sick pasengers and the supervision of the food and water uplift on board. Special attention is given to the indoctrination of the ground staff regarding toxic hazards of industrial materials and noise, and the establishment of a basic crash-rescue and crash-emergency setup. I.S.

**A87-40565#**
**GLYCOSYLATED HAEMOGLOBIN (HB A1) IN AEROMEDICAL EVALUATION OF DIABETES MELLITUS AND IMPAIRED GLUCOSE TOLERANCE**
R. N. DIWAN (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), S. K. ADAVAL, and R. GOKULNATH (Indian Air Force, Command Hospital, Bangalore, India) Aviation Medicine, vol. 29, Dec. 1985, p. 115-118.

Proper assessment of glycemic control is essential in the management of diabetes mellitus. Estimation of glycosylated hemoglobin (GHb) gives a better indication of the long-term blood glucose levels rather than isolated blood glucose estimations. The study comprised of 48 male subjects reporting for medical boards and 17 healthy adults as controls. The GHb values correlated well with the postprandial blood sugar levels. The values of GHb noted in this study in healthy controls and diabetics are comparable to those reported in literature. Author

**A87-40566#**
**CHANGES IN SOME HAEMATOLOGICAL PARAMETERS DURING SEVERE HEAT STRESS IN MAN**
N. SURESH BABOO (Indian Air Force, Institute of Aviation Medicine, Bangalore, India) Aviation Medicine, vol. 29, Dec. 1985, p. 119-126. refs

Thirteen healthy adult volunteers were exposed for 50 min in a hot environment of 57 C DB and 37.5 C WB with a wind velocity of 55 ft/min. Highly significant rise in the value of haemoglobin percent and a fall in ESR were observed. Total blood water loss was 2.13 percent. Eosinophil count showed a highly significant reduction of 33.2 percent after the exposure. A significant fall in the concentration of blood bicarbonate and hydrogen ions were also observed. As the controversy regarding the blood volume during heat stress is resolved to some extent by this study, the importance of fluid intake before a sortie in summer months is highlighted. The eosinophil could can be utilized at field level as a very simple test to evaluate the presence of stress. Author

**A87-40567#**
**TOTAL BLOOD SULFHYDRYL GROUP CHANGES DURING FLIGHT TRIALS**
E. M. IYER (Indian Air Force, Institute of Aviation Medicine, Bangalore, India) Aviation Medicine, vol. 29, Dec. 1985, p. 127-130. refs

A study was undertaken to prove the usefulness of blood-SH test in assessing the stress involved during various flight trials. Seven pilots participated in the transport/fighter aircraft flying. Pilots flying transport aircraft did not show any change, whereas the pilot flying the fighter aircraft showed a significant drop in the total blood-SH group (P less than 0.01). Usefulness of this test in the flight stress evaluation and the biochemical aspects of change in blood-SH group during transport/fighter aircraft are discussed. Author

**A87-40568#**
**PATTERN OF ENT DISABILITIES AMONGST ASPIRING FLYERS - A RETROSPECTIVE STUDY**
L. K. KOCHHAR and E. V. RAMAN (Indian Air Force, Air Force Central Medical Establishment, New Delhi, India) Aviation Medicine, vol. 29, Dec. 1985, p. 131-135. refs

Amongst the 3,416 medical evaluations carried out in the five year period from 1978 to 1982, 2202 individuals were assessed for award of flying category at first instance. The rate of denial of flying category to serving personnel was only 10.42 percent as compared to 35 percent for fresh entrants to NDA. However, ENT disabilities constituted as much as 21.81 percent of the total disabilities amongst serving personnel, compared to only 8.41 percent for fresh entrants. The commonest ENT cause of rejection was substandard hearing (60 percent) followed by eustachian tube insuffiency. Author

**A87-40904#**
**ELECTRODERMAL ACTIVITY AS AN INDEX OF MOTION SICKNESS**
L. A. WARWICK-EVANS, R. E. CHURCH, C. HANCOCK, D. JOCHIM, P. H. MORRIS (Southampton, University, England) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 417-423. refs

The correlations between electrodermal activity and a range of signs and symptoms of motion sickness were examined in four experiments, in which a total of 170 subjects were exposed to a cross-coupled force environment. Although increases in skin conductance did not correlate with specific single indices of motion sickness, correlations with a questionnaire based on several signs and symptoms varied from 0.89 (p less than 0.001) to 0.11 (N.S.). It is concluded that skin conductance potentially offers a valid and very precise measure of motion sickness, but that it is sensitive to extraneous factors only some of which are currently understood. Author

**A87-40905*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**PLASMA VOLUME AND ENDOCRINE RESPONSES TO WATER IMMERSION WITH INTERMITTENT POSITIVE-PRESSURE BREATHING IN MEN**
M. H. HARRISON, J. SILVER, L. KEIL, C. E. WADE, and J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field; U.S. Army, Letterman Army Institute of Research, San Fra Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 424-429. refs

**A87-40907#**
**ASYMPTOMATIC MICROSCOPIC HEMATURIA IN PILOTS**
PAUL FROOM, JOSEPH RIBAK, YAACOV TENDLER, ARNOLD CYJON, and MOSHE GROSS (Israel Air Force, Aeromedical Center, Ramat Gan, Israel) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 435-437. refs

Pilots were examined in order to determine whether the cumulative incidence or point prevalence of asymptomatic microscopic hematuria is associated with air duty. The cumulative incidence of recurrent microscopic hematuria over a 12-15 year period was 11.3 percent in fighter pilots, 10.0 percent in helicopter pilots, and 13.8 percent in transport pilots. Similarly, the point prevalence of microscopic hematuria in those who had flown the day prior to the urinalysis was no higher than found in the control group. It is concluded that air duty does not cause microscopic hematuria either chronically or during the day after the stress of air flight. Author

**A87-40908#**
**THE USE OF CONTACT LENSES BY USAF AVIATORS**
T. J. TREDICI and W. J. FLYNN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 438-443. refs

A clinical contact lens study was conducted on 33 USAF crew members who were unconditionally grounded because of medical conditions affecting their vision. Of these individuals, 31 (18 of the 19 pilots, 8 of the 9 navigators, and 5 of 5 other categories) were visually rehabilitated and returned to full flight status due to the use of contact lenses. However, it is emphasized that, in spite of the fact that wearing the contact lenses eliminates the compatibility problems of the spectacle-wearing crew members, contact lenses are not recommended for widespread use because of hazards that may be created by high-G forces (a potential for lens decentration and dislodgement during periods of aircraft acceleration), low atmospheric pressure (that may lead to bubble formation under the lens), and/or reduction in atmospheric oxygen (a potential cause of corneal edema). I.S.

**A87-40909#**
**PHYSICAL FITNESS IN A SUBMARINE COMMUNITY AS DETERMINED BY THE U.S. NAVY HEALTH AND PHYSICAL READINESS TEST**
B. L. BENNETT (U.S. Navy, Naval Submarine Medical Research Laboratory, Groton, CT) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 444-451. Navy-supported research. refs

**A87-40910#**
**CHARACTERISTICS OF MEDICALLY DISQUALIFIED AIRMAN APPLICANTS IN CALENDAR YEARS 1982 AND 1983**
SHIRLEY J. DARK (FAA, Civil Aeromedical Institute, Oklahoma City, OK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 452-460. refs

This study presents comprehensive data reflecting pertinent denial rates regarding the medical and general attributes of those airmen denied medical certification in the calendar years 1982 and 1983, and updates previously reported data with respect to medical certification denials. The annual denial rate based on airman applicants is 6.2 per 1000. By class of certificate applied for, the annual rate per 1000 applicants is 3.3 for first class, 3.8 for second class, and 8.6 for third class. As anticipated, general aviation and new applicants contribute greatly to total denials. The most significant causes for denial are cardiovascular, the miscellaneous pathology category (endocrinopathies, disqualifying medications, and administrative), neuropsychiatric and, at a substantially lower level, eye pathology. These updated data on medically disqualified applicants are consistent with expectations and previous findings, with cardiovascular diseases still the number one cause for denial. Author

**A87-40911#**
**BACK PAIN IN HELICOPTER AIRCREW - A LITERATURE REVIEW**
TIMOTHY BOWDEN (DND, Defence and Civil Institute of Environmental Medicine, Downsview, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 461-467. refs

Back pain in helicopter aircrew has been reported by the armed services of many countries. The problem is compared to the similar phenomenon of back pain in civilian industrial groups, particularly drivers and the operators of heavy equipment. In both drivers and helicopter aircrew, posture and vibration exposure have been identified as causes of the back pain. The significance of these factors, and the mechanisms that relate them to the discomfort, and possible solutions are discussed. Author

**A87-40912#**
**+GZ-INDUCED LOSS OF CONSCIOUSNESS - A CASE FOR TRAINING EXPOSURE TO UNCONSCIOUSNESS**
JAMES E. WHINNERY (USAF, School of Aerospace Medicine, Brooks AFB, TX) and RUSSELL R. BURTON (USAF, Center for Aerospace Doctrine, Research, and Education, Maxwell AFB, AL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 468-472. refs

The sequential stages of +Gz-induced loss of consciousness (G-LOC) were studied quantitatively using cervical cuff for inducing LOC due to a cerebral blood flow (CBF) arrest, or a rapid-onset centrifuge +Gz-stress to induce G-LOC. The onset and the duration of the absolute and relative incapacitation due to LOC, and the recovery period were timed for both experimental groups. Results indicated that the G-LOC lasts considerably longer than the LOC induced by CBF-arrest. On the other hand, in subjects who have experienced G-LOC, the periods of relative and total incapacitation were reduced, as compared to inexperienced subjects, by about 8 s each (from 24 to 16 s and from 12 s to 3.5 s, respectively). These results suggest that relative incapacitation may be a psychologically determined period, dependent on the awareness and recognition of symptoms. It is suggested that exposure to G-LOC during centrifuge training should become a part of the aircrew training program. I.S.

**A87-40949*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**GENERAL AUTONOMIC COMPONENTS OF MOTION SICKNESS**
PATRICIA S. COWINGS (NASA, Ames Research Center, Moffett Field, CA), STEVE SUTER (California State College, Bakersfield), WILLIAM B. TOSCANO, JOE KAMIYA, and KAREN NAIFEH (California, University, San Francisco) Psychophysiology (ISSN 0048-5772), vol. 23, Sept. 1986, p. 542-551. refs
(Contract NCC2-115)

This report refers to a body of investigations directed toward the examination of autonomic nervous system responses to motion sickness. Heart rate, respiration rate, finger pulse volume, and basal skin resistance were measured on 127 men and women before, during, and after exposure to a nauseogenic rotating chair test. Significant changes in all autonomic responses were observed across the tests (p less than .05). Significant differences in autonomic responses among groups divided according to motion sickness susceptibility were also observed (p less than .05). Results suggest that the examination of autonomic responses as an objective indicator of motion sickness malaise is warranted and may contribute to the overall understanding of the syndrome.
Author

**A87-41801#**
**THE FREQUENCY RESOLVING POWER OF HUMAN HEARING [CHASTOTNAIA RAZRESHAIUSHCHAIA SPOSOBNOST' SLUKHA CHELOVEKA]**
A. IA. SUPIN and V. V. POPOV (AN SSSR, Institut Evoliutsionnoi Morfologii i Ekologii Zhivotnykh, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 28-34. In Russian. refs

A novel method for directly measuring the level of the frequency resolving power of the human auditory system is described. Human subjects were exposed to noise signals (in the frequency range of 0-16 kHz) which had a comblike spectrum with regularly alternating minima and maxima of spectral density. A change in the modulation phase of the spectrum constituted a stimulus which could be recognized (in the perceptible range of the spectrum) as a change in timbre. It was found that at low ridge density, i.e., less than 4-5 peaks per kHz, the threshold depth of modulation was low (8-10 percent). At a ridge density of 5-7/kHz and higher, the threshold depth of modulation increased, reaching 100 percent at 20-25 peaks per kHz. In the high-frequency section of the hearing range, the relative density of frequency peaks (i.e., the ratio of frequency to the frequency interval between two spectral peaks) at which fine spectral structure can be resolved is about 30. I.S.

**A87-41802#**
**THE RESPONSES OF THE HUMAN RESPIRATORY SYTEM TO HYPOXIC AND HYPERCAPNIC STIMULI DURING ADAPTATION TO HIGH ALTITUDE [OTVETY DYKHATEL'NOI SISTEMY NA GIPOKSICHESKII I GIPERKAPNICHESKII STIMULY PRI ADAPTATSII CHELOVEKA K USLOVIIAM VYSOKOGOR'IA]**
T. V. SEREBROVSKAIA and T. G. DUBROVSKAIA (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 58-64. In Russian. refs

The sensitivity of the respiratory system to hypoxia and hypercapnia in healthy males living at sea level was compared with the sensitivity of men adapted to high-altitude conditions by living for one year at 1680 or 3650 m. Results of measurements of ventilation and gas-exchange parameters after exposures to experimental hypoxia and hypercapnia indicated that, in the subjects who have lived at the altitude of 3600 m, the ventilatory response to both the hypoxic and the hypercapnic stimuli was higher than in the other groups. These subjects could also tolerate a lower critical level of P(A)O2 but had a lower maximal level of tolerated hypercapnia. It was also found that subjects who exhibited elevated ventilation sensitivity to hypoxia at high altitude exhibit high work capacity at that altitude, elevated oxygen consumption, and lower levels of anaerobic glycolysis. However, these subjects were less stable to the critical levels of hypoxia. I.S.

**A87-41803#**
**AGE-RELATED FEATURES IN THE INTERACTION BETWEEN THE MECHANISMS REGULATING HEART RHYTHM AND RESPIRATION IN COAL MINERS [VOZRASTNYE OSOBENNOSTI VZAIMODEISTVIIA MECHANIZMOV REGULIATSII SERDECHNOGO RITMA I VNESHNEGO DYKHANIIA U GORNORABOCHIKH UGOL'NYKH SHAKHT]**
G. S. PEREDERII and V. P. GREBNIAK (Nauchno-Issledovatel'skii Institut Gigieny Truda i Profzabolevanii, Donetsk, Ukrainian SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 77-83. In Russian. refs

**A87-41804#**
**THE RELATIONASHIP BETWEEN THE CHANGES OF ARTERIAL PRESSURE AND THE TYPE OF MENTAL WORK UNDER EMOTIONAL STRESS [ZAVISIMOST' IZMENENII ARTERIAL'NOGO DAVLENIIA OT KHARAKTERA UMSTVENNOI DEIATEL'NOSTI V USLOVIIAKH EMOTSIONAL'NOGO NAPRIAZHENIIA]**
E. V. BELOVA, G. B. GOLOVANOVA, V. P. EMTSEVA, R. P. OL'KHA, O. G. RUDAKOVA (Moskovskii Meditsinskii Stomatologicheskii Institut, Moscow, USSR) et al. Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 84-89. In Russian. refs

Blood pressure reactions to different types of mental work performed under stress were studied in subjects performing two types of tests. The first group performed various computation assignments. The second group was tested by the methods of Rubinshtein (1970) and Baranovskaia et al. (1970); these tests included elements of chance and demanded shifts of attention and significantly higher concentration than the tests of the first type. It was found that the principal effect of the performance of calculations was an increase of systolic pressure. The tests of the second type were found to greatly intensify diastolic hypertension, due to a general increase in the resistance of peripheral vessels. I.S.

**A87-41805#**
**THE MECHANISM OF VOLUNTARY AND INVOLUNTARY REGULATION OF HUMAN ACTIVITY UNDER EXTREME CONDITIONS [MEKHANIZM PROIZVOL'NOI I NEPROIZVOL'NOI REGULIATSII DEIATEL'NOSTI CHELOVEKA V EKSTREMAL'NYKH USLOVIIAKH]**
V. I. MEDVEDEV, E. K. ZAV'IALOVA, and M. V. POLIKARPOVA (Voenno-Meditsinskaia Akademiia, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 90-95. In Russian. refs

A method for assessing the characteristics of the voluntary and involuntary regulation of the learning process in humans was developed and applied to assess the effects of 48 hour-long sleep deprivation and of sydnocarb intake on the type of learning-process regulation. It was found that in rested subjects the prevailing mechanism of learning is the voluntary regulation of the learning process, mediated by word command, while in subjects deprived of sleep the regulating function was transferred to the orientation reactions; thus, the relative efficiency of involuntary learning was greater in these subjects than in the rested controls. The sleep-deprived subjects committed more errors and signal misses and exhibited slower reactions to light signals (whether or not light signals were accompanied by sound signals) than did the controls. The intake of sydnocarb (four 17.5-mg doses) by sleep-deprived subjects had a beneficial effect, correcting insomnia-induced changes in the learning process. I.S.

**A87-41807#**
**NORMAL LEVELS OF BLOOD LIPIDS IN HEALTHY HUMANS [DOLZHNYE VELICHINY LIPIDOV KROVI U ZDOROVOGO CHELOVEKA]**
R. K. KISELEV, R. V. BELEDA, A. P. IVANCHIKOV, and V. I. PLAKHATNIUK Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 109-112. In Russian. refs

A method is proposed for estimating individual norms of blood cholesterol and triglycerides from the data of subjects' age, height,

and body weight. Data were collected from 2100 healthy males aged 18-57 and were used to compute linear regressions correlating chemically-analyzed blood concentrations of cholesterol or triglycerides with the three body parameters. Various linear combinations of power and logarithmic functions were considered. It was shown that in healthy subjects actual concentrations of both lipid groups agree within 10 percent with the established lipid norms. Subjects with atherogenic cardiovascular abnormalities displayed lipid cholesterol and triglyceride concentrations that were each more than 10 percent above the established normal levels. I.S.

**A87-41808#**
**VEGETATIVE REACTIONS IN HUMANS UNDER THE INFLUENCE OF VARIOUS HEAT/COLD REGIMENS OF A SAUNA [VEGETATIVNYE REAKTSII CHELOVEKA PRI RAZNYKH REZHIMAKH TEPLOKHOLODOVYKH VOZDEISTVII V USLOVIIAKH SAUNY]**
K. V. SUDAKOV, V. V. SINICHKIN, and A. A. KHASANOV (Nauchno-Issledovatel'skii Institut Normal'noi Fiziologii, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 113-120. In Russian. refs

Changes in vegetative reactions in response to heat exposure in a sauna followed by cooling in air or in water (shower and a water pool) were studied in six men who were regular sauna users. The experimental procedures consisted of five 9 min-long exposures to 40-45 C (wet thermometer), each followed by 16 min- or 20 min-long cooling in air or water, respectively. Each step was accompanied by measurements of peripheral temperature, blood pressure, and EKG parameters. In the first regimen (sauna followed by air cooling), at the end of each heat/cool cycle, sublingual temperature, skin temperature, and pulse rate were found to increase, while both systolic and diastolic pressures decreased slightly. The spatial dispersion of skin temperature (measured at four locations) decreased. Exposure to the second regimen (water cooling) led to decreases of sublingual and peripheral skin temperatures and of pulse rate, slight increases in systolic and diastolic pressures, and an increase of the skin temperature dispersion. I.S.

**A87-41809#**
**THE DYNAMICS OF THE BIOENERGETICS INDICES UNDER HYPERCAPNIA [DINAMIKA POKAZATELEI BIOENERGETIKI PRI GIPERKAPNII]**
V. L. MAKAROV, L. A. MOROZOV, and A. I. BORISOV Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 139-143. In Russian. refs

The effect of hypercapnia on contents of ATP, ADP, AMP, LDH isozymes, G6PD, and ATPase in blood was studied in healthy male operators exposed for 5 days to an atmosphere containing 2.0-2.5 percent CO2. Blood analyses were performed before the exposure, at the end of the 5th day, and 14 days later. It was found that total blood concentrations of ATP and ADP nucleotides remained unchanged during the course of the experiment; this stability is believed to be due to simultaneous decreases in both the nucleotide synthesis and their utilization. Hypercapnia caused increases in the relative activities of LDH-4 and LDH-5 in serum, indicating a metabolic shift towards anaerobic processes. In erythrocytes, concentrations of ATPase and LDH activities decreased, while those of ATP and G6PD increased, indicating a disruption of normal metabolic processes. These changes are considered to be adaptive rather than pathological. I.S.

**A87-41810#**
**CALCIUM-ION CONCENTRATION IN BLOOD AND ITS TEMPERATURE SENSITIVITY IN NORMAL CONDITIONS AND UPON ADAPTATION TO COLD [KONTSENTRATSIIA IONOV KAL'TSIIA V KROVI I TEMPERATURNAIA CHUVSTVITEL'NOST' V NORME I PRI ADAPTATSII ORGANIZMA K KHOLODU]**
T. V. KOZYREVA, A. IA. TIKHONOVA, A. P. TKACHENKO, and I. N. SINDAROVSKAIA (Institut Klinicheskoi i Eksperimental'noi Meditsiny, Novosibirsk, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 149-151. In Russian. refs

**A87-42162#**
**EVALUATION OF ADAPTATION TO HIGH ALTITUDE FROM THE STATISTICAL INDICES OF THE CARDIAC RHYTHM [OTSENKA ADAPTATSII K USLOVIIAM VYSOKOGOR'IA PO STATISTICHESKIM POKAZATELIAM RITMA SERDTSA]**
A. L. MAKSIMOV and A. P. LATOVIN Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Jan. 1987, p. 40, 41. In Russian.

A portable apparatus (Elektronika 01Ts) for measuring parameters of heart activity was used to evaluate the extent of adaptation to high-altitude hypoxia from the values of complex statistical indices of the cardiac rhythm (the pulse rate, the rhythm stability index, the vegetative rhythm index, and the stress index). In preliminary experiments performed at sea level all subjects (89 men aged from 18 to 45 y) were tentatively divided into three groups depending on their stability to hypoxia. After the subjects arrived at high-altitude locations (3200-3600 m above sea level), the statistical indices of cardiac rhythm were determined periodically (3 d, 15 d, 30 d, 2 months, and 1.5 year). It was found that cardiac adaptation (i.e., stabilization of the indices) occurred one month after ascent. The values of the statistical indices correlated well with the objective evaluation of the well-being of the subjects and are considered to be reliable indicators of adaptation to hypoxia. I.S.

**A87-42163#**
**DIAGNOSING CORONARY INSUFFICIENCY IN FLIGHT PERSONNEL [O DIAGNOSTIKE KORONARNOI NEDOSTATOCHNOSTI U LETNOGO SOSTAVA]**
V. I. KOLEDENOK, A. K. KOCHETOV, and N. A. LYSOGOR Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Jan. 1987, p. 42-45. In Russian. refs

Results obtained by using the orthostatic and the voluntary hyperventilation tests for diagnosing coronary insufficiency in flight personnel were compared with results of bicycle ergometer tests performed after intake of obsidan or nitroglycerin. Subjects included 95 men who have exhibited, during the submaximal load tests, a lowering (by more than 1 mm) of the EKG ST segment. It is shown that only when all three load tests are used is it possible to separate ischemic changes appearing on the EKG during the bicycle ergometry from the false positive results obtained sometimes in the orthostatic or the hyperventilation tests. The shape of the ST segment displacement and the proportionality of the degree of this displacement to the load magnitude are of major importance in diagnosing the ischemic condition. I.S.

**A87-42670*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
**BONE AND MUSCLE - THE STRUCTURAL SYSTEM IN LONG DURATION SPACE MISSIONS**
PAUL BUCHANAN (NASA, Kennedy Space Center, Cocoa Beach, FL) Space Studies Institute, Conference on Space Manufacturing, 8th, Princeton, NJ, May 6, 1987, Paper. 5 p. refs

Losses of bone mineral and muscle mass have been observed, and in varying degrees measured, following all long duration missions in space. These observations portend an unacceptable threat to the crews' ability to return to earth, without protracted rehabilitation, following periods of a year or more in microgravity. The impact to crew capabilities and productivity in space is not well understood. Past research has dealt with bone loss and muscle atrophy as two separate problems with little discernible relationship.

This paper reviews the available information on both and suggests a combined structural approach for future research. Author

**A87-42671*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
**CARDIOVASCULAR AND OTHER DYNAMIC SYSTEMS IN LONG-TERM SPACE FLIGHT**
DAVID A. TIPTON (NASA, Kennedy Space Center, Cocoa Beach, FL) Space Studies Institute, Conference on Space Manufacturing, 8th, Princeton, NJ, May 6, 1987, Paper. 7 p. refs

The paper examines the physiology of the cardiovascular system, and to a lesser extent the endocrine, renal, and hematopoietic systems. The paper highlights the aspects of these areas that are most pertinent to space manufacturing, i.e., working in space. Areas covered include the physiological costs of working in microgravity and partial gravity (e.g., the moon or Mars), countermeasures to potentially adverse physiological adaptations, and problems associated with return to earth after long periods of weightlessness. Author

**N87-24065#** Wisconsin Univ., Madison.
**PULMONARY ADAPTATION TO HIGH ALTITUDE Annual Progress Report, 14 Nov. 1984 - 1 Feb. 1986**
JEROME A. DEMPSEY Nov. 1986 6 p
(Contract DAMD17-82-C-2259; DA PROJ. 3M1-61102-BS-10)
(AD-A179139) Avail: NTIS HC A02/MF A01 CSCL 06S

Studies demonstrate the causes and consequences of periodic breathing during sleep at high altitudes, showed the susceptibility of the highly trained athlete to development of hypoxemia during heavy exercise at even very moderately high altitudes, and tested the effect of exercise in hypoxia on respiratory muscle fatigue. GRA

**N87-24066#** Baylor Univ., Dallas, Tex. Research Foundation.
**BIOMEDICAL APPLICATIONS OF THE FREE ELECTRON LASER Annual Report, Jan. - Dec. 1986**
J. L. MATTHEWS, M. M. JUDY, MICHAEL V. DENNIS, DAVID VANDERMUELEN, and DON NEALON 14 Apr. 1987 121 p
(Contract N00014-86-K-0186)
(AD-A179182; REPT-87-1) Avail: NTIS HC A06/MF A01 CSCL 06L

This study involves seven separate projects. The areas approached are the: modeling of porphyrin uptake, sequestration and photoxicity genetic in identical genetic cell lines, the photosensitizing properties of merocyanine, the modeling of sustained triplet population by FEL radiation in photoexcited porphyrins, tissue optical property measurements, thermal effects of laser irradiation on tissue, the near-ultraviolet effects on celluar tissue and the optical studies of protein flexibility using pulsed and modulated laser sources. Utilizing reverse-transforming techniques, a model system for porphyrin uptake and sequestration has been developed utilizing the commercially available porphyrin preparation, PHOTOFRIN II. Efficient photodynamical killing of the human promyelocytic leukemia HL-60 cell line under aerobic conditions after exposure to MC540 was demonstrated. A significant increase in the efficiency of HPD mediated photodynamical killing of a tumor by use pulse trained laser has occurred. Other than for skin and for blood, there appears to have been little systematic determination for the optical scattering and absorption coefficients of biological tissues. Measures are being taken to extend measurements of the scattering and absorption coefficients to a broad spectrum of major biological tissues. Histological and histochemical staining capabilities were developed for evaluating the tissue and cellular and subcellular level of thermally induced damage upon absorption of laser light. GRA

**N87-24067#** Duke Univ., Durham, N. C. Dept. of Psychiatry.
**INVESTIGATION OF BIOCHEMICAL VARIATION IN OPERATIONAL AIRCREW Final Report, Feb. - Dec. 1983**
REDFORD B. WILLIAMS, JR., JOHN C. BAREFOOT, and THOMAS L. HANEY Dec. 1986 23 p
(Contract F33615-82-D-0627)
(AD-A179223; USAFSAM-TR-85-56) Avail: NTIS HC A02/MF A01 CSCL 06S

Principal-components analyses of biochemical values obtained on a sample of operational aircrew revealed two factors that appear to reflect stress levels: Factor 1--positive loadings for Red Blood Cell sedimentation rate, serum uric acid, triglycerides, and cholesterol/HDL ratio; and Factor 4--a negative loading for serum calcium and positive loadings for 0900 plasma cortisol, fasting blood sugar, and Sodium/Potassiam ratio. High Factor-1 scores could result from increased sympathetic nervous system activity, and high Factor 4 scores could reflect heightened arousal of the pituitary-adrenocortical axis. Both are logical consequences of stress, whether due to chronic environmental pressures, individual characteristics predisposing to reduced stress tolerance, or some combination. The pattern of relationship between scores on these factors and individual variables such as command status and environmental variables such as aircraft type suggests that scores on Factors 1 and 4 are indeed valid indicators of stress. If further studies strengthen these conclusions, scores on these two factors may be useful measures of pilot attributes that should be routinely screened for, so as to select personnel with highest proficiency but least possible health risks. GRA

**N87-24068#** Northeastern Univ., Boston, Mass.
**MULTIPURPOSE VISUAL DISPLAY AND EYE MOVEMENT RECORDING SYSTEM Final Report, 15 Sep. 1984 - 15 Mar. 1986**
ALEXANDER A. SKAVENSKI 5 Feb. 1987 3 p
(Contract AF-AFOSR-0312-84)
(AD-A179620; AFOSR-87-0533TR) Avail: NTIS HC A02/MF A01 CSCL 14C

The instrumentation to build a complete eye movement recording and visual display facility is centered on a Generation V, SDI Double Purkinje Image Eye Tracker which permits high resolution 2 dimensional eye movement recording in a 20 deg arc field without contacting the human subject's eye. Visual stimulation is produced on a high resolution color monitor which is driven by a video tape recorder or by digitally stored and processed images from the computer. Eye movement data from the tracker are digitized for storage, analysis and plotting by a PDP 11/73 computer. The system is presently operational and we are beginning experimental work. The first experiments involve finding out why an accurate eye position signal is available for localization judgements requiring that the body be pointed at the target but not when judgements are made solely within the visual modality. Details are found in the original proposal. Equipment cost breakdown is included. GRA

**N87-24069#** New York Univ., New York. Dept. of Psychology.
**THE PERCEPTION OF THE HIGHER DERIVATIVES OF VISUAL MOTION Final Report, 30 Sep. 1985 - 1 Oct. 1986**
L. KAUFMAN 5 Mar. 1987 18 p
(Contract AF-AFOSR-0329-85)
(AD-A179627; AFOSR-87-0435TR) Avail: NTIS HC A02/MF A01 CSCL 06P

This final report provides a brief overview of work conducted prior to the final hear of this project, as more complete descriptions have been published. The overview covers work done on the sensitivity of the perceptual system to changing speed. The stimuli were sinusoidal gratings drifting normal to the lengths of their bars, and speed was modulated. Threshold modulation of speed was about 12% of average speed, although performance was better for higher spatial frequencies and higher average speeds. To avoid effects of contour change, we adopted a random dot approach in which threshold for motion of dots was determined as a function of the proportion of dots exhibiting correlated motion. Thus, threshold is expressed as a signal to noise ratio. For the

detection of uniform motion of moderate speed, the percent correlation was about 5.7, i.e., 5 or 6 dots out of 100 had to move together, with all the other dots in random motion. There was approximately a 47% increase in threshold for change in direction of motion where the change in direction was about 30 deg. However, in a parametric experiment it was found that there was a monotonic decrease in threshold with amount of change in direction. Where the change in direction was only 2 deg, it could not be detected even with 100% correlation. At 3 deg 96% correlation was required. Only 14% correlation required at 30 deg. GRA

**N87-24070#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

**SHORT COURSE ON CARDIOPULMONARY ASPECTS OF AEROSPACE MEDICINE**

Loughton, England Mar. 1987 130 p Course held in Fuerstenfeldbruck, West Germany, 18-20 May 1987, in Athens, Greece, 21-23 May 1987, in Copenhagen, Denmark, 9-11 Jun. 1987, and in Eskisehir, Turkey, 15-17 Jun. 1987

(AGARD-R-758; ISBN-92-835-1544-7) Avail: NTIS HC A07/MF A01

Lectures and case presentations delivered as part of a course on the cardiopulmonary aspects of aerospace medicine are compiled. The major thrust of the course was directed toward aeromedical decision making. Medical problems such as arrhythmias, coronary disease, valvular disease, hypertension, and bronchiopulmonary disease are addressed. Diagnostic and screening techniques are also discussed.

**N87-24071#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

**AEROMEDICAL EVALUATION AND DISPOSITION OF ELECTROCARDIOGRAPHIC ABNORMALITIES**

WILLIAM B. KRUYER *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 8 p Mar. 1987

Avail: NTIS HC A07/MF A01

Electrocardiographic abnormalities are discussed with regard to their aeromedical significance, evaluation, and disposition. Sinus bradycardia, sinus and ventricular tachycardia, atrioventricular block, axis deviation, right and left bundle branch block, ventricular hypotrophy, tachyarrhythmias, atrial abnormalities, and short PR syndromes are addressed. Evaluation of the significance of these abnormalities is based on aviator cardiographic records in the USAF Central Electrocardiographic Library. The importance of natural history follow-up studies is emphasized. M.G.

**N87-24072#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Clinical Sciences Div.

**NONINVASIVE METHODS FOR THE DETECTION OF CORONARY ARTERY DISEASE IN AVIATORS: A STRATIFIED BAYESIAN APPROACH**

JAMES R. HICKMAN, JR. *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 11 p Mar. 1987

Avail: NTIS HC A07/MF A01

The detection of asymptomatic coronary disease is a major goal of most aeromedical services, especially those associated with high-performance aircraft. Unfortunately, the pursuit of silent coronary artery disease with contemporary noninvasive diagnostic methods has been disappointing. This lecture discusses the epidemiological principles which underlie this rather poor performance of contemporary diagnostic tools in a population where coronary artery disease is of low prevalence. The underlying statistical problem is best explained by analysis of Bayes' theorem, which applies conditional probability analysis to diagnostic tests which are not perfect. The predictive power of a positive diagnostic test is very heavily dependent upon the prevalence of the disease in the population being tested. Unlike sensitivity and specificity, which are independent of disease prevalence, predictive value is strongly influenced by stratification of the test population into subsets with high pretest probability of disease. Strategies to improve the poor performance of contemporary noninvasive tools in the testing of otherwise healthy individuals are discussed. The USAF School of Aerospace Medicine Risk Index is offered as a theoretical, but unvalidated, stratification tool. M.G.

**N87-24073#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

**VALVULAR AND CONGENITAL HEART DISEASE IN THE AVIATOR**

WILLIAM B. KRUYER and ROBERT S. SCHWARTZ *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 12 p Mar. 1987

Avail: NTIS HC A07/MF A01

Many valvular and congenital heart lesions can have major impact in the aviation environment. In the flying population, such lesions are typically asymptomatic and may be subtle enough that their presence can be detected only by very careful physical or laboratory examination. Thus, valvular or congenital cardiac disease is often found in a flier in whom there is a great deal of time, effort, and monetary investment. The loss of such an individual from flying status should thus be avoided if at all possible. As in all aeromedical decisions, these considerations must be weighed against the likelihood of significant impairment while performing aviation duties resulting either directly or indirectly from the cardiac lesion of concern. In light of these conflicting considerations, a discussion of regulations and medical aspects of specific valvular and congenital problems as approached by the USAF School of Aerospace Medicine is presented. Author

**N87-24074#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Clinical Sciences Div.

**AEROMEDICAL ASPECTS OF MITRAL VALVE PROLAPSE**

JAMES R. HICKMAN, JR. *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 7 p Mar. 1987

Avail: NTIS HC A07/MF A01

Mitral valve prolapse (MVP) continues to be a major aeromedical problem. Current issues revolve around diagnostic criteria, aeromedical thresholds for disqualification and the lack of definitive natural history studies upon which to base aeromedical decisions. Currently, there are no existing natural history studies of incidentally discovered mitral valve prolapse in the asymptomatic male. The USAF School of Aerospace Medicine is following over 300 mitral valve prolapse subjects on a recurrent basis in order to determine this natural history. The comparison of this natural history group with age-matched controls should be completed in approximately 1988. Preliminary data offered in this report enumerate the most common grounding causes of mitral valve prolapse in the first 202 aviators with prolapse in the study. A suggested scheme for clinical evaluation, aeromedical disposition of MVP and suggested aeromedical diagnostic criteria are offered. Author

**N87-24075#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

**PULMONARY PHYSIOLOGY AND PULMONARY FUNCTION TESTING IN AEROSPACE MEDICINE**

G. W. GRAY *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 8 p Mar. 1987

Avail: NTIS HC A07/MF A01

Respiratory diseases may have serious consequences in the aviation environment, ranging from life threatening incapacitation (e.g., tension pneumothorax) to aggravation of hypoxia, acceleration atelectasis and perhaps lowered G tolerance in individuals with relatively minor degrees of small airways disease. Some concepts of respiratory physiology which are of particular relevance in the aviation environment are reviewed and current methods of pulmonary function testing which can be applied to detect asymptomatic disease in aircrew are discussed. Author

**N87-24076#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Central Medical Establishment.
**AEROMEDICAL DISPOSITION OF PULMONARY SARCOIDOSIS, CHRONIC OBSTRUCTIVE LUNG DISEASE, REACTIVE AIRWAY DISEASE AND SPONTANEOUS PNEUMOTHORAX**
DAVID H. HULL *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 5 p Mar. 1987
Avail: NTIS HC A07/MF A01

Four respiratory diseases are described in relation to aviation medicine: sarcoidosis, chronic obstructive lung disease, reactive airway disease, and spontaneous pneumothorax. Each is discussed in the context of flying safety, operational efficiency, and problems of treatment. Guidelines are offered for decisions on management and disposal of aircrew candidates and of trained aircrew who have a history of one of these diseases or who develop the disease during their flying career. Author

**N87-24077#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**HYPERTENSION IN THE AVIATOR**
WILLIAM B. KRUYER *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 3 p Mar. 1987
Avail: NTIS HC A07/MF A01

Systemic hypertension is one of the most commonly encountered medical problems for both the general medical practitioner and the specialist in aerospace medicine. Its frequent occurrence, its contribution to the risk of cardiovascular events, and problems with early detection and compliance with therapy all make hypertension a health problem of significant concern. It is clear from the literature that therapy for moderate and severe hypertension significantly reduces morbidity and mortality. However, much study and debate has occurred regarding the benefit of mild hypertension. The appropriateness of therapy for mild hypertension is discussed based on a review of several major studies from the world literature. Detrimental effects of thiazide diuretics have been reported, prompting interest in the use of smaller doses of thiazide diuretics as well as interest in the use of other agents as first line therapeutic choices. Current USAF policies regarding the treatment of hypertension in aviation are discussed as well as considerations that must be addressed in the study of new medications for use in the aviator population. Author

**N87-24078#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Clinical Sciences Div.
**CORONARY RISK FACTORS IN AEROSPACE MEDICINE**
JAMES R. HICKMAN, JR. *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 8 p Mar. 1987
Avail: NTIS HC A07/MF A01

Coronary risk factors may be used in the aeromedical setting to identify aviators who are at high risk for the development of coronary artery disease and are, therefore, at a higher risk for sudden incapacitation. Coronary risks may be used to identify those aviators who need additional testing in an attempt to discover asymptomatic coronary disease. Coronary risk factor analysis should also be applied to the entire aviator population in order to identify those aviators who need routine or intensive risk factor modification. Certain lipid patterns, especially familial hyperlipidemia patterns, may be used to identify younger trainees who do not represent a good long-term training investment because of high risk of subsequent development of coronary artery disease. Author

**N87-24079#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**CARDIOPULMONARY SCREENING FOR HIGH-PERFORMANCE FLYING: SELECTION AND RETENTION ISSUES**
G. W. GRAY *In* AGARD Short Course on Cardiopulmonary Aspects of Aerospace Medicine 4 p Mar. 1987
Avail: NTIS HC A07/MF A01

Detection methods used in the cardiopulmonary screening of aircrew are discussed with reference to candidate selection standards and retention of older experienced pilots. Aircrew candidate screening emphasizes the diagnosis of mostly asymtomatic diseases and disorders. It is designed to identify structural cardiac abnormalities and cardiac arrhythmias that may be a problem in the high +G(z) environment. Screening should also be directed toward pulmonary disorders which may compromise human effectiveness in rapid onset high G (ROHG) and high sustained G (HSG) fighter operations. In experienced aircrew, screening emphasis shifts to the detection of abnormalities which develop with age, particularly, coronary heart disease and small airways disease. Current issues including tobacco smoking, the effects of repetative HSG on the heart and lungs, minimal coronary heart disease, and coronary angioplasty are also discussed. M.G.

**N87-24080#** Brookhaven National Lab., Upton, N. Y.
**INTERNATIONAL SYMPOSIUM ON IN VIVO BODY COMPOSITION STUDIES: PROGRAM AND ABSTRACTS**
1986 97 p Symposium held at Upton, N.Y., 28 Sep. 1986
(Contract DE-AC02-76CH-00016)
(DE87-006750; BNL-39428; CONF-8609203) Avail: NTIS HC A05/MF A01

This booklet contains the program and individual abstracts for papers presented at the International Symposium on In Vivo Body Composition Studies. The presentations were divided into five sessions. Individual abstracts were indexed for the Energy Data Base. DOE

**N87-24081#** Lawrence Livermore National Lab., Calif.
**HAZARDS EVALUATION OF RADIOFREQUENCY AND MICROWAVE RADIATION**
G. C. MILLER Mar. 1987 74 p
(Contract W-7405-ENG-48)
(DE87-008536; UCID-20978) Avail: NTIS HC A04/MF A01

This manual is primarily for Industrial Hygienists. The basic concepts of protection from radiofrequency and microwave radiation (RFMW) are presented here to help readers recognize and evaluate RFMW-associated potential health hazards and to understand the technical issues in public debates about RFMW. This manual contains the technical background for understanding and measuring RFMW. The control of RFMW radiation is not covered, requiring as it does a degree of familiarity with electrical engineering. The appendices are designed for use by RFMW surveyors in the field. Included are a summary of bioeffects studies, common RFMW sources, field survey protocols, and formulas for field measurement calculations. Upon completion of this manual, industrial hygienists should be in a position to handle most radiofrequency and microwave emergencies and should know when to call for assistance. While essentially a classroom training aid, the manual can also stand alone as a guide. DOE

**N87-24082#** Army Research Inst. of Environmental Medicine, Natick, Mass.
**OPERATION EVEREST 2: IMPORTANCE OF VENTILATION IN DEFENSE OF MAXIMAL OXYGEN UPTAKE AT EXTREME ALTITUDES**
ALLEN CYMERMAN, PAUL B. ROCK, JOHN R. SUTTON, JOHN T. REEVES, and BERTRON M. GROVES Nov. 1986 36 p
(AD-A177874) Avail: NTIS HC A03/MF A01 CSCL 06S

The role of ventilation in the reduction of maximal aerobic power was studied in 8 subjects exposed to progressive simulated altitudes of 3962, 6096, 7468, and 8839 m (barometric pressures of 464, 347, 289, 240 Torr, respectively), as members of Operation Everest 2, a 40-day simulated ascent of Mt. Everest. The mean

(+ or - SEM) maximal oxygen uptake (VO2 max) was decreased from 4.13 + or - 0.20 at sea level (SL) to 1.2 + or - 0.08 l/min at P sub B 240 Torr. Maximal heart rate also decreased while arterial oxygen saturation was reduced. Maximal exercise ventilation at all barometric pressures compared to SL with a significant increase occurring at 464 Torr. Both frequency (f) and tidal volume (TV) contributed to the increase in VE (with f tending to be higher and TV lower for any VE at SL). A higher correlation was found between SaO2 and VO2 max than with heart rate and VO2 max. The rank order of subjects for VE/VO2 at SL was essentially the same as that at 240 Torr. VO2 max was reduced in all subjects 2 days after return to SL reaching 82% of the original mean while associated values for VE, f and TV were not different, suggesting that responses which improve or maintain exercise performance at altitude persist for at least several days after return to SL to the detriment of VO2 max. It was concluded that ventilatory control is not lost under severe, progressive hypoxia; that a strong response is paramount to maintaining VO2 max; and that ventilation may be more critical than circulation in preserving VO2 max. GRA

**N87-24083#** Naval Submarine Medical Research Lab., Groton, Conn.
**THE REVIEW OF A RESEARCH PROPOSAL TO STUDY THE EFFECTS OF 130 TORR OXYGEN ON SUBMARINES HELD AT GROTON, CONNECTICUT ON SEPTEMBER 4, 1986**
DOUGLAS R. KNIGHT and ARTHUR B. CALLAHAN 29 Jan. 1987 18 p
(AD-A177976; NSMRL-MR-87-1) Avail: NTIS HC A02/MF A01 CSCL 06S

The extinguishments for fire aboard patroling submarines relies on crew action and speed of response. Therefore, anything that slows the growth of fires will assist crews in bringing fires under control. Submarines routinely operate with oxygen concentrations close to 19%. Snorkeling rarely drops a ship's internal pressure below 700 torr, but accidental circumstances could create a partial vacuum of -5 inches mercury. The effects of reduced oxygen concentration and partial vacuums can be studied in an altitude chamber. The selection of physiological and psychological tests is appropriate, except for collecting blood samples which attempt to measure arterial oxygen content and detect damage to organs such as the liver. The exposure time of 8 days is appropriate in the absence of data showing that longer exposure at 5,000 ft altitude cause delayed onset of mountain sickness. GRA

**N87-24084#** Texas A&M Univ., College Station.
**POTENTIAL ELECTRON BEAM INDUCED FLASHBLINDNESS IN PILOTS Final Report, Oct. 1985 - Aug. 1986**
NORMA D. MILLER and THOMAS G. WHEELER Nov. 1986 26 p
(Contract F33615-83-D-0602)
(AD-A178002; USAFSAM-TR-86-31) Avail: NTIS HC A03/MF A01 CSCL 06R

A simplified but representative situation of a flat windscreen and visor in front of a pilot's eyes has been defined to evaluate the potential for flashblindness caused by Cerenkov radiation, produced by a 1-sec exposure to relativistic electrons with velocities of about 0.95 c. The spectral and spatial distribution of the Cerenkov radiation in the windscreen and visor from the electron beam has been calculated to find the additional retinal illumination contributed by them. On the basis of the calculations performed and of a brief survey of existing data, the following five estimates can be made: (1) Absolute threshold for the Cerenkov radiation from the windscreen and that produced in the eye is equivalent to a 3-Microrad beam of 0.95 c electrons. (2) Cone threshold for the Cerenkov radiation produced in the eye is equivalent to 0.8 rads; and, for that produced in the windscreen, 0.09 rad. (3) Extrapolating from foveal and parafoveal data, a 10-rad beam would cause a 2.5-sec interruption in visibility for low contrast targets in the mid-scotopic adaptation range in the region of the windscreen arcs. (4) Insufficient data exist for proper evaluation of the flashblindness effect in the periphery at scotopic levels, so the estimate in item 3 may be conservative by a large factor. (5) No possibility exists for flashblindness from Cerenkov radiation in the mid-photopic range at sublethal doses. GRA

**N87-24085#** Tufts Univ., Medford, Mass. Dept. of Anatomy and Cellular Biology.
**TRAINING, MUSCLE FATIGUE, AND STRESS FRACTURES Annual Report, 15 Nov. 1985 - 14 Nov. 1986**
CLINTON T. RUBIN 15 Dec. 1986 13 p
(Contract DAMD17-86-C-6088; DA PROJ. 3M1-61102-BS-10)
(AD-A178350) Avail: NTIS HC A02/MF A01 CSCL 06P

The abrupt increase in physical activity required during basic training frequently leads to stress fractures in the lower limbs of new recruits. During peacetime, stress fractures are the most common physical injury in military populations. The objective of this three year research program is to study the etiology of the stress fracture lesion for which purpose, two parallel experimental protocols were begun: (1) the effect of muscle fatigue on bone strain distributions and, (2) the effect of repetitive cyclic loading on bone remodeling. The summation of these two protocols will provide unique insight towards the effect of new strain regimens on skeletal remodeling. The development of an experimental protocol in 4 horses to determine the effect of fatigue and uncoordinated muscle activity on the distribution, magnitude and rate of change of strains developed in vivo within the cannon bone. Experimental methodology includes bone-bonded rosette strain gauges, liquid metal strain gages attached to tendon, surface and muscle embedded electro-myographs, heart and ventilation frequencies, blood lactate production, maximum oxygen consumption, and carbon dioxide production. GRA

**N87-24873#** Naval Health Research Center, San Diego, Calif.
**EFFECT OF AEROBIC TRAINING ON THE PLASMA ACTH RESPONSE TO EXERCISE Interim Report**
MICHAEL J. BUONO, JOHN E. YEAGER, and ANTHONY A. SUCEC 1 Sep. 1986 9 p
(AD-A178430; NAVHLTHRSCHC-86-28) Avail: NTIS HC A02/MF A01 CSCL 06N

The purpose of this study was to re-examine the effect of training on plasma ACTH levels during exercise. Ten adult volunteers were split into a control and an experimental group. The experimental group participated in a 12-week training program which resulted in a significant 11% increase in their mean maximal oxygen uptake. The plasma ACTH response to a 150W workload was measured in both groups before and after the training program. The experimental group demonstrated a significant reduction in the delta ACTH response to the workload, while the control group demonstrated an unchanged response over the course of the study. These data suggest that the ACTH response to an absolute, submaximal workload is blunted following training. Such a finding is in agreement with previous studies that have shown that ACTH follows an intensity dependent pattern during exercise. GRA

**N87-24874*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**PHOTOREFRACTOR OCULAR SCREENING SYSTEM Patent**
JOHN R. RICHARDSON, inventor (to NASA) and JOSEPH H. KERR, inventor (to NASA) (Medical Sciences Corp., Huntsville, Ala.) 2 Jun. 1987 11 p Filed 28 Sep. 1984 Supersedes N85-20639 (23 - 11, p 1692)
(NASA-CASE-MFS-26011-1-SB; US-PATENT-4,669,836; US-PATENT-APPL-SN-655605; US-PATENT-CLASS-351-206; US-PATENT-CLASS-354-62; US-PATENT-CLASS-351-208)
Avail: US Patent and Trademark Office CSCL 06P

A method and apparatus for detecting human eye defects, particularly detection of refractive error is presented. Eye reflex is recorded on color film when the eyes are exposed to a flash of light. The photographs are compared with predetermined standards to detect eye defects. The base structure of the ocular screening system is a folding interconnect structure, comprising hinged sections. Attached to one end of the structure is a head positioning station which comprises vertical support, a head positioning bracket having one end attached to the top of the support, and two head positioning lamps to verify precise head positioning. At the opposite

end of the interconnect structure is a camera station with camera, electronic flash unit, and blinking fixation lamp, for photographing the eyes of persons being evaluated.
Official Gazette of the U.S. Patent and Trademark Office

**N87-24875#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES**
10 Mar. 1987 88 p Transl. into ENGLISH from various Russian articles
(JPRS-UBB-87-006) Avail: NTIS HC A05/MF A01
Topics addressed include: aerospace medicine; biochemistry; biotechnology; radiations effects; genetics; clinical medicine; microbiology; immunology; toxicology; pharmacology; physiology; and public health.

**N87-24876#** Joint Publications Research Service, Arlington, Va.
**STUDY OF MUSCLE BIOENERGETICS IN WEIGHTLESSNESS**
E. S. MAILYAN, E. A. KOVALENKO, and L. V. BURAVKOVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 1-7 10 Mar. 1987 Transl. into ENGLISH from Patologicheskaya Fiziologiya i Eksperimentalnaya Terapiya (Moscow, USSR), no. 5, Sep. - Oct. 1985 p 69-73
Avail: NTIS HC A05/MF A01
The parameters of oxidative phosphorylation and the activity of cytochrome oxidase and lactate dehydrogenase were studied in the skeletal muscles of rats exposed on 3 biosputniks of the Kosmos series. An 18 to 22 day space flight leads to marked inhibition of oxidative metabolism and glycolysis in skeletal muscles of different morphofunctional specializations, disorders of oxidative phosphorylation conjugation and reduced activity of the studied enzymes. Muscular tissue respiration was restored by the end of the first month of the readaptation period. The need for studying the bioenergetic processes in skeletal muscles is emphasized by the fact that the muscular system, which plays a major role in energy and heat formation processes of the body, is also one of the main targets affected by weightlessness. The pathogenic mechanisms of functional muscular insufficiency in the postflight period are still not understood completely. The processes of oxidative phosphorylation and the activities of certain oxidative enzymes in the skeletal muscles of albino rats were investigated at various times in the postflight period. Author

**N87-24877#** Navy Experimental Diving Unit, Panama City, Fla.
**REPEATED MEASUREMENT OF DIVERS' WORD FLUENCY Final Report**
ROBERT C. CARTER, MICHAEL D. CURLEY, and DAVID J. STYER Apr. 1987 26 p
(AD-A179965; NEDU-3-87) Avail: NTIS HC A03/MF A01 CSCL 06E
Word Fluency is an aspect of human behavior that can be a useful indicator of possible neurological effects of long, deep undersea diving, acute decompression sickness, and arterial gas embolism. Testing of divers' Work Fluency before, during, and after dives requires availability of multiple, equivalent but different tests of Word Fluency. This report describes the procedures used to develop and evaluate Word Fluency test forms suitable for repeated measurement experimental designs. Alternate, parallel forms of a Word Fluency test are recommended. Results are presented of illustrative measurements of Word Fluency before, during, and after 30-day saturation dives to simulated depths of 259m and 335m, and of follow-up measurements of a central nervous system decompression sickness case. These results indicate that a Word Fluency test could be a sensitive indicator of environmental stress. Normative data for divers using several letters are presented. GRA

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## BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**A87-40149#**
**THE INFLUENCE OF VISUAL WORKLOAD HISTORY ON VISUAL PERFORMANCE**
MICHAEL L. MATTHEWS (Guelph, University, Canada) Human Factors (ISSN 0018-7208), vol. 28, Dec. 1986, p. 623-632. NSERC-supported research. refs
Two experiments are reported that demonstrate that visual search for a signal from a number of potential signal sources in a sustained monitoring task is dependent upon previous visual-load history. It is shown that both temporal and spatial variations in load produce performance decrements, and occasionally increments, that cannot be predicted from static-load experiments. These data are not consistent with previous attempts to explain performance changes associated with workload history. An interpretation is offered in terms of the persistence of information-processing strategies across changing task conditions. Author

**A87-40150*#** Ohio State Univ., Columbus.
**MODELING FAULT DIAGNOSIS AS THE ACTIVATION AND USE OF A FRAME SYSTEM**
PHILIP J. SMITH, WALTER C. GIFFIN, THOMAS H. ROCKWELL, and MARK THOMAS (Ohio State University, Columbus) Human Factors (ISSN 0018-7208), vol. 28, Dec. 1986, p. 703-716. refs
(Contract NAG2-112)
Twenty pilots with instrument flight ratings were asked to perform a fault-diagnosis task for which they had relevant domain knowledge. The pilots were asked to think out loud as they requested and interpreted information. Performances were then modeled as the activation and use of a frame system. Cognitive biases, memory distortions and losses, and failures to correctly diagnose the problem were studied in the context of this frame system model. Author

**A87-40635#**
**SENSITIVITY LOSS IN ODD-SYMMETRIC MECHANISMS AND PHASE ANOMALIES IN PERIPHERAL VISION**
PATRICK J. BENNETT and MARTIN S. BANKS (California, University, Berkeley) Nature (ISSN 0028-0836), vol. 326, April 30, 1987, p. 873-876. NIH-supported research. refs
Discrimination thresholds for compound gratings at several eccentricities were measured in order to specify the properties of foveal and peripheral phase-encoding mechanisms. The results are consistent with a two-channel model of phase encoding based on even- and odd-symmetric mechanisms, but the sensitivity of the odd-symmetric mechanisms decreases dramatically with eccentricity. Thus, the loss of sensitivity in one type of mechanism may underlie the reduced ability to encode spatial phase peripherally. C.D.

**A87-40850#**
**COOPERATIVE PHENOMENA IN THE PERCEPTION OF MOTION DIRECTION**
DOUGLAS WILLIAMS and GREGORY PHILLIPS (Northwestern University, Evanston, IL) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 4, May 1987, p. 878-885. refs
(Contract AF-AFOSR-80-0246)
A percept of global coherent motion can result from the combination of many different localized motion vectors. The paper reports evidence of hysteresis in the perception of this global motion, obtained with random-dot cinematograms. The hysteresis characteristics are relatively robust with respect to changes in dot density, display area, and location. Changing the directional content of the stimulus, however, did alter the hysteresis profile in a manner

consistent with a model incorporating cooperative interactions among direction-selective motion mechanisms. The present results lend further support to a cooperative interpretation of motion perception in random-dot cinematograms. Author

**A87-40901#**
**SLEEP AND WAKEFULNESS OF THE AIRLINE PILOT (THE 1986 STEWART MEMORIAL LECTURE)**
ANTHONY N. NICHOLSON (RAF, Institute of Aviation Medicine, Farnborough, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 395-401. Research supported by the Civil Aviation Authority. refs

The sleep and wakefulness patterns of the long-range flight aircrew are discussed along with the factors which influence these patterns and the role of correct workload and schedule designs. The importance of short periods of sleep and of naps between periods of work for the maintenance of crew alertness is emphasized, and the problems arising in two-crew operations and in long-range three-crew operations are examined. It is also emphasized that the sleep pattern features of individual crew members must be considered in schedule designs and in selecting crew members for long-range flights. I.S.

**A87-40902*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**INFLIGHT APPLICATION OF THREE PILOT WORKLOAD MEASUREMENT TECHNIQUES**
SANDRA G. HART (NASA, Ames Research Center, Moffett Field, CA) and JAN R. HAUSER (Xerox, Inc., Palo Alto, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 402-410. refs

Three inflight techniques for workload measurement were tested in nine pilots flying the NASA Kuiper Airborne Observatory: subjective ratings, heart rate, and communication performance. The activities that contributed to the crew-member workload varied; the commander was responsible for aircraft control and navigation whereas the copilot handled communications. The three workload measures were found to provide different information. Pilot ratings of workload, effort, and stress were sensitive to variations in flight-related task demands across flight segments but did not reflect specific differences in the type of demands imposed on the commander and the copilot. The heart rate was sensitive to the differential impact of duties, being higher for the commander than for the copilot. The rate of communications per minute of flight proved to be the most sensitive indicator. It was related to workload, stress, effort rating, and average heart rate across flight segments. I.S.

**A87-40906#**
**THE EFFECT OF SPECTRALLY SELECTIVE FILTERS ON VISUAL SEARCH PERFORMANCE**
G. T. CHISUM, J. B. SHEEHY, P. E. MORWAY, and G. K. ASKEW (U.S. Navy, Naval Air Development Center, Warminster, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 430-434. refs

The effect of five spectrally selective filters on the performance of an acuity-dependent visual search task was evaluated. The filters were: (1) a neutral density filter (control condition); (2) a 5200 A green interference filter; (3) a 3215-250 red filter; (4) a neodymium visor; and (5) a holographic visor. The observers were presented with five blocks of 10 slides per filter. Each slide projected a 6 x 6 deg field of 900 letter O's, each 10 sec of arc, which contained a single Landolt C. The observers were required to find the C and indicate the position of the opening in the C. The opening in the C subtended 2.64 sec, corresponding to an acuity of 0.38. Response time, error rate, accommodative accuracy, and the number and duration of fixations were recorded for each slide presentation. The results demonstrated that filter type had no effect on any of the response measures. Author

**N87-24086#** Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
**PERCEPTION AND STRUCTURAL ANALYSIS OF MORPHOLOGIES**
CLAUDIE FAURE Aug. 1986 36 p
(ENST-86D004; ISSN-0751-1345; ETN-87-99608) Avail: NTIS HC A03/MF A01

For seismic signals, human perception of analogy between signals; and for speech spectrogram segmentation, expert decisions which include high level knowledge, are compared to automatic decisions. Automatic decisions quite often fit human decisions and disagree when high level knowledge, which is used by subjects, is not included in the pattern recognition system, but, also, automatic decisions are made by using information that is disregarded by the subjects. Hence, automatic processing cannot be considered to be a bad imitation of human process but as a different process which has its own behavior. Adaptation to the context is one of the most difficult problems to solve for automatic interpretation of patterns. ESA

**N87-24878#** Sequoia Associates, Inc., Arlington, Va.
**A SEARCH FOR POSITIVE RESPONSE LEVEL INDICATORS (PRLI'S) UNDER STRESS Final Report, 1 Oct. 1984 - 2 Mar. 1987**
J. M. MURRAY Mar. 1987 166 p
(Contract EMW-84-C-1557)
(AD-A178373) Avail: NTIS HC A08/MF A01 CSCL 05J

Effective economic and human resources planning requires quantitative knowledge of human response levels under stress. In this project, the Essential Workers' Supportiveness Index was designed and tested as an instrument for measuring the positive response levels of a population's willingness to support overall national emergency. The theoretical basis of the research was Gittinger's Personality Assessment System (PAS), augmented by Saunders' PAS-derived Fourth Dimension. The EWSI made use of these concepts, and it is suitable for mass testing. It was administered to a sample of 1530 subjects from two geographic areas and included 23 categories of essential workers. Four primary types of stress-related behaviors were identified: Phlegmatic and Egocentric, which were unsupportive (80.6 percent). Training modalities were devised to improve supportiveness (positive response levels) in all four types of behaviors. Recommendations for further testing were made. Report contains a Spectrum of Emergencies, a Bibliography on Economic Stabilization, and a Bibliography on the Personality Assessment System. GRA

**N87-24879#** Universidade Nova de Lisboa (Portugal). Lisboa (portugal).
**DECREASING DAMAGING EFFECTS OF STRESS-BOUND SITUATIONS: TOWARDS A NEW MODEL OF LEADERSHIP UNDER STRESS Interim Report, Nov. 1985 - Oct. 1986**
ORLINDO PEREIRA and JORGE JESUINO Jan. 1987 73 p
(Contract DAJA45-85-C-0036; DA PROJ. 2Q1-61102-B-74-F)
(AD-A178379; ARI-RN-87-01) Avail: NTIS HC A04/MF A01
CSCL 05J

In jobs or tasks where no possibility exists to avoid stress (e. g. combat action) repeated exposure is likely to produce relatively permanent damage in groups or individuals. Previous research demonstrated this fact in the case of marines involved in counter-guerrilla activity. Pereira and Jesuino (1982, using Fiedler's model as a framework, have shown that appropriate leadership can buffer the consequences of stress. To understand how such an effect comes about, the authors developed and began test on a model of leadership-group transactions. The results of this field study show that leadership has a significant bearing on the stressors strain interface. Bureaucratic expertise is a prerequisite for leader and subordinates' acceptance of one another. Continuation of the research and some practical applications of the findings are discussed. GRA

**N87-24880#** Aircraft Owners and Pilots Association, Frederick, Md.
**AERONAUTICAL DECISION MAKING FOR INSTRUMENT PILOTS Final Report**
RICHARD S. JENSEN, JANEEN ANDRION, and RUSSELL S. LAWTON May 1987 91 p
(Contract DTFA01-80-C-10080)
(DOT/FAA/PM-86/43) Avail: NTIS HC A05/MF A01

Aviation accident data indicate that the majority of aircraft mishaps are due to judgement error. This training manual is part of a project to develop materials and techniques to help improve pilot decision making. Training programs using prototype versions of these materials have demonstrated substantial reductions in pilot error rates ranging from approximately 10 to 50% fewer mistakes. This manual is designed to explain the risks associated with instrument flying activities, the underlying behavioral causes of typical accidents, and the effects of stress on pilot decision making. It provides a means for the individual pilot to develop an Attitude Profile through a self-assessment inventory and provides detailed explanations of preflight and in-flight stress management techniques. The assumption is that the pilots will develop a positive attitude toward safety and the ability to effectively manage stress while recognizing and avoiding unnecessary risk. The manual is one of a series on Aeronautical Decision Making prepared for the following pilot audiences: (1) Student and Private; (2) Commercial; (3) Instrument; (4) Instructor; (5) Helicopter; and (6) Multi-Crew.
Author

**N87-24881#** Aircraft Owners and Pilots Association, Frederick, Md. Program Engineering and Maintenance Service.
**AERONAUTICAL DECISION MAKING FOR INSTRUCTOR PILOTS**
GEORGETTE BUCH, ed., RUSSELL S. LAWTON, ed., and GARY S. LIVACK, ed. May 1987 73 p
(Contract DTFA01-80-C-10080)
(DOT/FAA/PM-86/44) Avail: NTIS HC A04/MF A01

Aviation accident data indicate that the majority of aircraft mishaps are due to judgment error. This training manual is part of a project to develop materials and techniques to help improve pilot decision making. Training programs using prototype versions of these materials have demonstrated substantial reductions in pilot error rates, ranging from approximately 10% to 50% fewer mistakes. This manual is designed to explain the risks associated with flight instruction activities, the underlying behavioral causes of typical accidents, and the effects of stress on pilot decision making. It teaches judgment concepts in contrast to the imparting of knowledge and the development of airmanship skills in conventional flight training. It also provides detailed explanations of pre-flight and in-flight stress management techniques.The assumption is that CFI's receiving this training will develop a positive attitude toward safety and the ability to effectively manage stress while recognizing and avoiding unnecessary risk. The manual is one of a series of Aeronautical Decision Making prepared for the following pilot audiences: (1) Student and Private; (2) Commercial; (3) Instrument; (4) Instructor; (5) Helicopter; and (6) Multi-Crew.
Author

**N87-24882*#** Johns Hopkins Univ., Baltimore, Md. School of Medicine.
**BEHAVIORAL AND BIOLOGICAL INTERACTIONS WITH SMALL GROUPS IN CONFINED MICROSOCIETIES Final Report**
JOSEPH V. BRADY Nov. 1986 39 p
(Contract NAG2-139)
(NASA-CR-181012; NAS 1.26:181012) Avail: NTIS HC A03/MF A01 CSCL 05I

Research on small group performance in confined microsocieties was focused upon the development of principles and procedures relevant to the selection and training of space mission personnel, upon the investigation of behavioral programming, preventive monitoring and corrective procedures to enhance space mission performance effectiveness, and upon the evaluation of behavioral and physiological countermeasures to the potentially disruptive effects of unfamiliar and stressful environments. An experimental microsociety environment was designed and developed for continuous residence of human volunteers over extended time periods. Studies were then undertaken to analyze experimentally: (1) conditions that sustain group cohesion and productivity and that prevent social fragmentation and performance deterioration, (2) motivational effects performance requirements, and (3) behavioral and physiological effects resulting from changes in group size and composition. The results show that both individual and group productivity can be enhanced under such conditions by the direct application of contingency management principles to designated high-value tasks. Similarly, group cohesiveness can be promoted and individual social isolation and/or alienation prevented by the application of contingency management principles to social interaction segments of the program. M.G.

**N87-25051#** Glasgow Univ. (Scotland). Dept. of Physics and Astronomy.
**THE IMPACT OF THE COSMOS ON THE HUMAN RACE**
ARCHIE E. ROY *In* ESA Proceedings of the GIREP Conference 1986. Cosmos: An Educational Challenge p 149-151 Nov. 1986 Avail: NTIS HC A20/MF A01

It is suggested that throughout its history, the development of the human race, physically, mentally and spiritually, is shaped by the cosmos, never more so than at the present time when it engages in a search for extraterrestrial intelligence. ESA

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## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**A87-39524#**
**ANALYSIS, DESIGN AND APPLICATIONS OF FIN LINES**
BHARATHI BHAT and SHIBAN K. KOUL Norwood, MA, Artech House, 1987, 489 p. refs

Progress made over the last ten years in the analysis, design, and applications of fin lines is consolidated in this book. Millimeter waves and various types of transmission lines proposed thus far for microwave and millimeter-wave circuit applications are reviewed, and the basic principles, analyses, design formulas, and characteristics of various practical fin-line configurations are presented systematically. Theory and design of the basic building blocks that constitute fin-line circuits are covered in detail, and the state of the art for the various fin-line components is reviewed. C.D.

**A87-39595#**
**ROBOTIC-EXPERIMENT FOR D2-MISSION**
JENS BUESING Dornier Post (English Edition) (ISSN 0012-5563), no. 1, 1987, p. 48-51.

The perception of the necessity to promote space applications of the robotic technology in the Federal Republic of Germany, led in 1985 to a proposal for an orbital robotic experiment. This proposal defines the robotic technology experiment, 'ROTEX', to be executed in the D2-mission, consisting of a six-axis manipulator, mounted in a single rack of the Spacelab module. The robot shall perform several experiments in automatic and telemanipulation mode. Author

**A87-40098#**
**PROPOSED APPLICATION OF AUTOMATED BIOMONITORING FOR RAPID DETECTION OF TOXIC SUBSTANCES IN WATER SUPPLIES FOR PERMANENT SPACE STATIONS**
ERIC L. MORGAN (Tennessee Technological University, Cookeville), MICHAEL D. SMITH (Tennessee Valley Authority, Knoxville), KENNETH W. EAGLESON (North Carolina Department of Natural Resources and Human Development, Raleigh), and RICHARD C. YOUNG (Institute of Environmental Sciences, Space Simulation Conference, 14th, Baltimore, MD, Nov. 1986) Journal of Environmental Sciences (ISSN 0022-0906), vol. 30, Mar.-Apr. 1987, p. 47-49. refs

The objective of this study was to present proposed design characteristics and applications of automated biomonitoring devices for real-time toxicity detection in drinking water supplies on-board permanent space stations. Tests in transmissions of automated biomonitoring data to earth-receiving stations were simulated using satellite data linkage from remote earth-based stations. Emphasis was placed on developing methods for detecting species-specific bioelectric potentials produced by unrestrained bivalve mussels and other sedentary invertebrates since these animals are presumably more easily maintained in near zero gravity than fish. In achieving this objective, differential amplifiers were constructed for measuring a wide range of response signals induced by various biological activities from fish and invertebrate subjects. Specific responses were detected as discrete analog signals, each converted to a digital voltage, and filed in computer storage. A management program provided various means for data gathering, filing, and retrieval. Author

**A87-40335#**
**LIFE-SUPPORT SYSTEMS FOR SPACE CREWS [SISTEMY ZHIZNEOBESPECHENIIA EKIPAZHEI LETATEL'NYKH APPARATOV]**
VLADIMIR VIKTOROVICH MALOZEMOV, VALERII FEODOS'EVICH ROZHNOV, and VLADIMIR NIKOLAEVICH PRAVETSKII Moscow, Izdatel'stvo Mashinostroenie, 1986, 584 p. In Russian. refs

The effects on humans of environmental conditions specific for a space flight, such as high altitude, cosmic radiation, weight overloads during the acceleration/deceleration stages, weightlessness, noise and vibration, magnetic fields, and ion-containing atmosphere, are discussed together with the ergonomic and technological demands placed on the life-support (LS) systems of manned spacecraft. Consideration is given to systems designed to regenerate the environment of a spacecraft, including systems for the conservation of air and water, for food storage, and for biological regeneration. Systems for maintaining the temperature and humidity inside the spacecraft and for using external heat sources are discussed. Special attention is given to mathematical models of various LS systems and subsystems. Block diagrams are included. I.S.

**A87-40352*#** National Aeronautics and Space Administration, Washington, D.C.
**THE NASA AUTOMATION AND ROBOTICS TECHNOLOGY PROGRAM**
LEE B. HOLCOMB and MELVIN D. MONTEMERLO (NASA, Washington, DC) IN: EASCON '86; Proceedings of the Nineteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, Sept. 8-10, 1986 . New York, Institute of Electrical and Electronics Engineers, Inc., 1986, p. 1-8. refs

The development and objectives of the NASA automation and robotics technology program are reviewed. The objectives of the program are to utilize AI and robotics to increase the probability of mission success; decrease the cost of ground control; and increase the capability and flexibility of space operations. There is a need for real-time computational capability; an effective man-machine interface; and techniques to validate automated systems. Current programs in the areas of sensing and perception, task planning and reasoning, control execution, operator interface, and system architecture and integration are described. Programs aimed at demonstrating the capabilities of telerobotics and system autonomy are discussed. I.F.

**A87-40363#**
**COMPLEX SYSTEM MONITORING AND FAULT DIAGNOSIS USING COMMUNICATING EXPERT SYSTEMS**
J. Y. READ, T. P. HOWLAND, and W. A. PERKINS (Lockheed Missiles and Space Co., Inc., Palo Alto, CA) IN: EASCON '86; Proceedings of the Nineteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, Sept. 8-10, 1986 . New York, Institute of Electrical and Electronics Engineers, Inc., 1986, p. 102-109. refs

Using an enhanced version of the Lookheed Expert System, a communicating expert system for fault diagnosis and fault correction in a prototype for the Space Station Air Revitalization System was developed. The system consists of three communicating expert systems, one for oxygen generation; one for CO2 removal; and a supervisor for overall control. The three expert system modules communicate via mailboxes. The purpose of this work is to gain an understanding of the problems involved and advantages of using such a communicating expert systems framework. Author

**A87-40377#**
**PLANNING FOR SPACE ROBOTICS DEVELOPMENTS AND APPLICATIONS**
DAVID R. CRISWELL (California, University, La Jolla) IN: EASCON '86; Proceedings of the Nineteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, Sept. 8-10, 1986 . New York, Institute of Electrical and Electronics Engineers, Inc., 1986, p. 244-250. refs

Recommendations of the Consortium for Space Automation and Robotics concerning ways to improve the effectiveness of humans in space are examined. Consideration is given to design capture of the Space Station, and the use of smart robots on the Space Station. The applications of space automation and robotics to the initial operating configuration; the operation, maintenance, and housekeeping of the Space Station; and the servicing of satellites are discussed. I.F.

**A87-40382#**
**INVESTIGATION OF AN ANOMALOUS CANADARM BRAKE BEHAVIOUR**
J. M. TRENOUTH and C. W. MACKENZIE (National Aeronautical Establishment, Ottawa, Canada) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 32, Sept. 1986, p. 205-213. refs

During the development of the Canadarm, its various components had been subjected to a number of tests at both acceptance and qualification levels. One of these involved the measurement of the slip torque of the joint drive brakes while operating under space-simulated conditions of temperature and pressure. In the latter stages of qualification testing, instances in which brake units showed a temporary decrease in brake slip torque had been observed. In order to assist in determining the cause of this behavior, an investigation of the phenomenon was undertaken in this laboratory. The testing prior to this investigation is briefly reviewed and the NAE test results are presented. Author

**A87-40519#**
**PRAGMATIC SIMULATION AND ITS APPLICATION TO TRAINING FLIGHT SIMULATORS [SYMULACJA PRAGMATYCZNA I JEJ ZASTOSOWANIE W TRENINGOWYCH SYMULATORACH LOTU]**
JANUSZ M. MORAWSKI Instytut Lotnictwa, Prace (ISSN 0509-6669), no. 104-105, 1986, p. 11-27. In Polish. refs

Human-oriented simulation concepts are presented which can be applied in all cases involving direct contact between the model and its user; particular emphasis is placed on real-time flight simulators. The approach used is based on semiotics concepts and on knowledge of sensory perception characteristics which assumes the existence of an internal model in the subject's mind. The semiotics approach is based on the division of this science into syntax, semantics, and pragmatics. The contact between the

model and its direct interpreter apparantly takes place at the level of pragmatics. B.J.

**A87-40523#**
**A GENERAL METHOD FOR HIGH-FIDELITY REPRODUCTION OF MOTION SENSATIONS IN THE FLIGHT SIMULATOR COCKPIT [KOMPLEKSOWY SYSTEM ODWZOROWAN WRAZEN RUCHU W KABINIE SYMULATORA LOTU]**
MARIUSZ KRAWCZYK Instytut Lotnictwa, Prace (ISSN 0509-6669), no. 104-105, 1986, p. 93-119. In Polish. refs

A preliminary concept of a motion system for a flight simulator is presented which illustrates the practical use of the principles of pragmatic simulation. The method assumes that the computed aircraft motion variables are subjected to further transformation, the purpose of which is to achieve high-fidelity of pilot sensations in a simulator as compared with those appearing in real flight. The approach presented takes use of an accurate knowledge of the static and dynamic properties of the vestibular organ. The concept of the simulator cockpit motion is reduced to three main degrees of freedom, i.e., pitch and roll angles, and a vertical displacement. The angular degrees of freedom are used in a complex way to simulate not only angular velocities, but also to reproduce long term components of linear acceleration as well as a substitute force representing some essential effects sensed by the pilot. An additional advantage may be obtained by the proper use of a g-suit. Author

**A87-40844#**
**ROBOTS ON THE SPACE STATION**
ERIC J. LERNER Aerospace America (ISSN 0740-722X), vol. 25, June 1987, p. 42-45.

Teleoperated robotic devices, or 'telerobots', such as those in use at nuclear processing facilities, are undergoing Space Station applicability evaluations which give attention to such questions as the degree of autonomy feasible or desirable for such devices and their most advantageous location. The mechanical elements of the telerobot are noted to require the most intensive modification for operations in a microgravity environment, due to the presence of backlash in many of its operations. A torque feedback loop has been developed which directly controls the force borne by arm joints. O.C.

**A87-40903#**
**CLOTHING SURFACE AREA AS RELATED TO BODY VOLUME AND CLOTHING MICROENVIRONMENT VOLUME**
NAOSHI KAKITSUBA, HENRY MICHNA, and IGOR B. MEKJAVIC (Simon Fraser University, Burnaby, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, May 1987, p. 411-416. Research supported by the British Columbia Science Council. refs

The ratio of clothing surface area to body surface area, f(cl), is generally accepted as a function of clothing insulation. To predict the value of f(cl), the clothing fit of four helicopter pilot suits (Goretex, cotton ventile, Nomex/Insulite, and Nomex) was evaluated by means of measuring a newly introduced factor, termed 'radiation area factor', which is defined as the ratio of the effective radiation area to the body surface area, Ar/A(D). The values of the Ar/A(D) were derived, evaluating the A(r) from the pictures of subjects wearing either of the four suits or street clothing. On the basis of the results, a new approach is proposed for predicting the f(cl) as a function of the body volume and the clothing microenvironment volume. I.S.

**A87-40995#**
**LEGIBILITY STUDY OF MULTIPLEXED TWISTED NEMATIC LCDS BASED ON COLORIMETRY AND MATCHING TESTS**
HIROSHI KUBOTA, TAKESHI MARUSHIGE, TAKAHIKO TAKABAYASHI, SHUNSUKE KOBAYASHI (Tokyo University of Agriculture and Technology, Koganei, Japan), and TERUO SHIMOMURA (Kyushu Institute of Technology, Kitakyushu, Japan) Applied Optics (ISSN 0003-6935), vol. 26, May 1, 1987, p. 1709-1713. refs

The effect of driving waveform, reflective vs backlit transmissive mode, and contrast polarity, on the legibility of a multiplexed twisted nematic (TN) LCD were investigated. The backlit transmissive mode with a white display pattern on dark background (W/B contrast) resulted in superior display legibility, while the reflective mode TN LCD with a dark display pattern on white background (B/W contrast) resulted in the second-best legibility. The maximum legibility was obtained at a lower operating voltage for the LCD with W/B contrast compared with the B/W contrast; it is believed that this can be attributed to the nonlinear response of the human eye. Author

**A87-41153#**
**THE CANADIAN ROBOTIC SYSTEM FOR THE SPACE STATION**
DOUGLAS CASWELL (National Research Council of Canada, Ottawa) and DEV GOSSAIN (Spar Aerospace, Ltd., Remote Manipulator Systems Div., Toronto, Canada) AIAA, NASA, and USAF, Symposium on Automation, Robotics and Advanced Computing for the National Space Program, 2nd, Arlington, VA, Mar. 9-11, 1987. 6 p.
(AIAA PAPER 87-1677)

The general concept of the Mobile Servicing Center and the Special Purpose Dextrous Manipulator (SPDM), both of which are parts of the Space Station Mobile Servicing System, is described. The role of the SPDM in the assembly and maintenance of the Station and the servicing of payloads and other equipment is outlined. Planning activities for technology diffusion and exploitation of the terrestrial economy are also addressed. C.D.

**A87-41155*#** Oak Ridge National Lab., Tenn.
**TELEROBOTIC TECHNOLOGY FOR NUCLEAR AND SPACE APPLICATIONS**
J. N. HERNDON and WILLIAM R. HAMEL (Oak Ridge National Laboratory, TN) AIAA, NASA, and USAF, Symposium on Automation, Robotics and Advanced Computing for the National Space Program, 2nd, Arlington, VA, Mar. 9-11, 1987. 13 p. NASA-sponsored research. refs
(Contract DE-AC05-84OR-21400)
(AIAA PAPER 87-1690)

Developments in telerobotics applicable to nuclear and space environments are discussed. The advanced servomanipulator (ASM) slave arm force-reflected servomanipulators designed for modular remote maintainability of the Advanced Integrated Maintenance System is examined. Consideration is given to the master controller, transporter, interface package, operator control station, and the control system for the ASM arm. A prototype of a telerobot capable of performing the activity of an astronaut during EVA is developed. The mechanical and control system features of the telerobot are described. I.F.

**A87-41811#**
**A BILOCULAR MODEL OF PAIN SENSITIVITY REGULATION UNDER STIMULATION OF SENSORY STRUCTURES [DVUKHKAMERNAIA MODEL' REGULIATSII BOLEVOI CHUVSTVITEL'NOSTI PRI STIMULIATSII SENSORNYKH STRUKTUR]**
L. I. KALAKUTSKII (Kuibyshevskii Aviatsionnyi Institut, Kuibyshev, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Jan.-Feb. 1987, p. 153-157. In Russian. refs

A bilocular model of pain sensitivity regulation is proposed. The model describes the principles governing pain manifestation and pain depression by activation of the nociceptive and the antinociceptive systems. The model is used to analyze the case of anesthetic transdermic electric neurostimulation (TDENS) and

to choose optimal parameters and regimens of TDENS treatment. The schematic diagram of the model is presented. I.S.

**N87-23644#** Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Ergonomics and Cockpit System.

**COMPUTER SIMULATION STUDIES ON HUMAN CONTROL RELIABILITY IN MANUAL AIRCRAFT CONTROL: THE ORIGIN OF PIO**

K. BRAUSER and R. SEIFERT *In* AGARD Flight Simulation 19 p Sep. 1986

Avail: NTIS HC A16/MF A01

Pilot induced oscillations usually are defined as a sensitive indication of bad handling qualities. In the view of human performance reliability, PIO's are related to input errors with respect to the control characteristics of the controlled system. It is a general rule that man will make errors while performing arbitrary tasks under the influence of possible performance shaping factors (PSF's). A recently developed Task Taxonomy Method is used as a tool for the assessment of Human Error Probabilities (REP) depending quantitatively on the effects of performance shaping factors (PSF) like task dimensions and characteristics, operator characteristics, system characteristics and environment factors. Using this Task Taxonomy procedure, HEP values for the manual aircraft control task have been calculated. HEP values are drastically increased (0.5 to 0.9) by the influence of bad handling qualities, while good handling qualities may only reduce the HEP value to 0.1, because other PSF's may remain still active. Therefore PIO incidents remain possible, even in aircraft with good handling qualities. This has been demonstrated by means of SAINT computer simulations using appropriate HEP values. Author

**N87-24087#** Army Construction Engineering Research Lab., Champaign, Ill.

**FULL-SCALE TEST PROGRAM FOR A SHOWER WASTEWATER RECYCLING SYSTEM: TECHNICAL EVALUATION Interim Report**

RICHARD J. SCHOLZE, JOHN T. BANDY, DONALD K. JAMISON, JAMES A. MORGAN, and VINCENT J. CICCONE Jan. 1987 39 p

(AD-A178061; CERL-N-87/06) Avail: NTIS HC A03/MF A01 CSCL 13B

A shower wastewater recycling system is investigated for potential military use under conditions of limited water supply. Results are reported for laboratory tests on the proposed system. Parameters measured in the tests include those specified by the Office of the Surgeon General (OTSG) in the Interim Quality Criteria for direct reuse of water as well as several others of concern. The laboratory test results show that the wastewater recycling system merits further investigation and development. The proposed system is compatible with existing Army facilities and equipment and is portable. Wastewater can be treated to a quality meeting OTSG standards. Several recycles are possible, with 85 percent of the wastewater recoverable for reuse. No harmful contaminants were detected in any of the test samples. GRA

**N87-24088#** Army Construction Engineering Research Lab., Champaign, Ill.

**THE FIELD SHOWER WASTEWATER RECYCLING SYSTEM: DEVELOPMENT OF A PROGRAM OF INSTRUCTION AND PRELIMINARY ANALYSIS OF ITS POTENTIAL HEALTH IMPLICATIONS Final Report**

RICHARD J. SCHOLZE, JOHN T. BANDY, WILLIAM P. GARDINER, WINIFRED CURLEY, and ED D. SMITH Feb. 1987 70 p

(AD-A178112; CERL-TR-N-87/07) Avail: NTIS HC A04/MF A01 CSCL 13B

Discussed is the development of a suggested program of instruction for operators of a Field Shower Wastewater Recycling System (FSWRS)--a system designed to recycle water used in showers in the field. A 40-hour training course is recommended. These operations will emphasize water treatment procedures and water sampling and testing. Analysis of field needs indicated that water quality testing can be limited to measurements of pH, turbidity, and residual chlorine and that these measurements can be made with relatively unsophisticated equipment. It was found that most constituents of shower wastewater that could pose health hazards will be removed during FSWRS recycling operations. However, basic procedures should be followed, such as avoiding ingestion of recycled shower waters and ensuring that FSWRS operators take appropriate precautions in handling sulfuric acid and untreated waters. Although no health hazards are anticipated to result from components such as soaps and shampoos, there is concern about the hazard potential of volatile organic compounds, heavy metals, chlorinated compounds, and chlorination byproducts. The most likely health effects would be skin and eye irritations. GRA

**N87-24089#** Naval Submarine Medical Research Lab., Groton, Conn.

**MEDICAL RESEARCH PROGRAMS, PAST AND FUTURE, FOR DESIGNING ATMOSPHERES TO RETARD FIRES**

DOUGLAS R. KNIGHT 7 Feb. 1987 14 p

(AD-A178354; NSMRL-MEMO-87-2) Avail: NTIS HC A02/MF A01 CSCL 13L

One method of improving submarine fire safety is to retard the flammability of combustible materials with atmospheres containing less than or = 19% oxygen. This should only be done if it is known that crews can effectively perform their occupation in the oxygen-lean environment. The purpose of this report is to summarize the history of research in this special topic of submarine medicine. The report is concluded with an outline of work needed to provide nuclear submarine commanders the option of using fire-retardant atmospheres aboard patroling submarines. GRA

**N87-24883#** Factor-H, Inc., Tempe, Ariz.

**PHYSIOLOGICAL ASSESSMENT OF PILOT WORKLOAD IN THE A-7 AIRCRAFT Final Technical Paper, Jan. 1984 - Jul. 1985**

ERNEST LINDHOLM, NORWOOD SISSON, MILTON J. MILLER, and MARGARET E. TOLDY Apr. 1987 30 p Prepared in cooperation with Interface Research Associates, Inc., Scottsdale, Ariz.

(Contract F33615-81-C-0005)

(AD-A178937; AFHRL-TP-86-25) Avail: NTIS HC A03/MF A01 CSCL 06S

Custom hardware and software were developed to permit the inflight recording of as many as 23 aircraft parameters,and the heart and respiration activity of a pilot flying an A-7 aircraft. G-forces, altitude, and velocity were systematically manipulated in three environments which differed with respect to the quality of visual cues for depth perception. The results showed that heart rate was most sensitive to changes in altitude, somewhat less sensitive to changes in velocity, and least sensitive to G-forces. Heart rate was also sensitive to the visual cue quality of the environment, but only for maneuvers performed at low altitude. Respiration activity covaried with changes in aircraft parameters, but this relationship could be detected only by multivariate analysis techniques. In some cases, heart rate did not show the predicted increases, and it is suggested that rapid changes in blood pressure would be valuable to assess in future investigations. GRA

**N87-24884#** Joint Publications Research Service, Arlington, Va.

**USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES**

18 Feb. 1987 98 p Transl. into ENGLISH from various Russian articles

(JPRS-UBB-87-004) Avail: NTIS HC A05/MF A01

Topics addressed include: aerospace medicine; biochemistry; genetics; biophysics; clinical medicine; microbiology; pharmacology; toxicology; and physiology.

**N87-24885#** Joint Publications Research Service, Arlington, Va.
**CHANGES IN HUMAN BODY FUNCTIONS UPON INGESTION OF READY MADE FOOD CONCENTRATES**
E. P. TSYGANOV, A. N. AGUREYEV, YE. V. KOLCHIN, V. S. DUPIK, and A. A. GUBERNATOROV *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 37-41 18 Feb. 1987 Transl. into ENGLISH from Voprosy Pitaniya (Moscow, USSR), no. 1, Jan. - Feb. 1986 p 30-33
Avail: NTIS HC A05/MF A01

When making small size rations (SSR) for individual needs, ready for use or for emergency stock, it is necessary to consider several factors. Of these the three most important are: the necessity to contain energy and nutrition rich food in a small unit mass; the length of time and convenience of storage, and the durability and reliability of the packaging. Developing and improving an SSR with an optimal ratio of basic food ingredients is an urgent unresolved problem of food hygiene. Changes in the body function of volunteers who consumed ready-to-use food concentrate briquettes packed as a single-portion SSRs were studied. The experimental results served as proof that there were no changes in health and no significant alteration in the studied functional indexes of the subjects maintained for 3 days on a diet of SSRs, in ready-made concentrated briquettes designed for individual use. Author

**N87-24886** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**EFFECTS OF VISUAL DISPLAY AND MOTION SYSTEM DELAYS ON OPERATOR PERFORMANCE AND UNEASINESS IN A DRIVING SIMULATOR Ph.D. Thesis**
LAWRENCE HENRY FRANK 1986 247 p
Avail: Univ. Microfilms Order No. DA8704673

The role of visual-motion coupling delays and cueing order on operator performance and uneasiness were assessed in a driving simulator by means of a response surface methodology (RSM) central-composite design. Three levels of visual delay and three levels of motion delay were completely crossed in the two-factor, between-subjects, central-composite design. Six subjects were assigned to each of the nine treatment conditions based upon pretest scores on the rod-and-frame test and under the constraint that an equal number of males and females were assigned to each treatment. The most salient finding was that visual delay appears to be more disruptive to an individual's control performance and well-being than is motion delay. Empirical multiple regression models were derived to predict 10 reliable measures of simulator operator driving performance and comfort. Principal components analysis on these 10 models decomposed the dependent measures into two significant models which were labeled vestibular disruption and degraded performance. A secondary analysis of the role of subject gender and perceptual style on susceptibility to simulator sickness revealed that neither of these independent variables was a significant source of variance.
Dissert. Abstr.

**N87-24887#** Monash Univ., Clayton (Australia). Human Factors Group.
**HUMAN FACTORS IN COMMAND-AND-CONTROL SYSTEM PROCUREMENT**
CONN V. COPAS, THOMAS J. TRIGGS, and JEREMY G. MANTON Dec. 1985 158 p
(HFR-15; ISBN-0-86746-312-0) Avail: NTIS HC A08/MF A01

A review is presented of various human factors engineering techniques that could be used at the early stages of a procurement program for computer based tactical information systems. The various stages of the program are discussed with regard to the prominent human factors issues that should be addressed. Some recommendations are made concerning the management of procedures for implementing human factors and some study topics are suggested for short term projects in a research institution. Two appendices are included. Appendix A deals with issues related to user involvement in the design process and Appendix B outlines some studies that have examined human factors issues in design programs. Guidance is provided concerning the types of methods used to promote decisions relating to the human factors aspects that will enhance system performance at all phases of development of a well engineered workplace for the human operator. Author

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## SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

**A87-39661#**
**THE ORGANIC COMPONENT IN DUST FROM COMET HALLEY AS MEASURED BY THE PUMA MASS SPECTROMETER ON BOARD VEGA 1**
J. KISSEL (Max-Planck-Institut fuer Kernphysik, Heidelberg, West Germany) and F. R. KRUEGER (Arheilger Apotheke, Darmstadt, West Germany) Nature (ISSN 0028-0836), vol. 326, April 23, 1987, p. 755-760. BMFT-ESA-supported research. refs

The composition of cometary dust studied by the Vega 1 spacecraft during its encounter with comet Halley was analyzed by mass spectroscopy, and the results are discussed. The results of impact ionization mass spectra are examined, including the properties of ion formation and dust particles and the chemistry of organic molecular-ion formation. Findings from the analysis of molecular ions, including the types of organic molecules inferred from single and cumulative mass spectra and the presence of lines from related ion species, are considered. Most particles are found to consist of a predominantly chondritic core with an organic mantle composed mainly of highly unsaturated compounds. The findings do not support the hypothesis of Hoyle and Wickramasinghe (1986) that the organic part of comet dust consists of spermiae. However, the substances in the cometary dust are highly reactive in warm water; the implications for the origin of life are discussed. C.D.

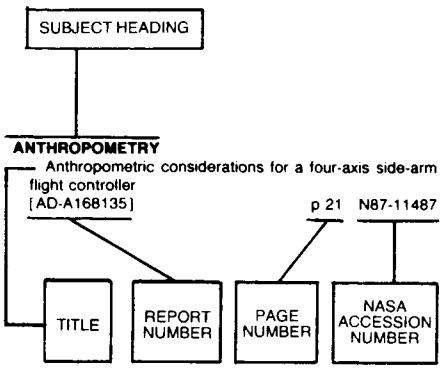
**A87-40940#** Salk Institute for Biological Studies, San Diego, Calif.
**RNA CATALYSIS AND THE ORIGINS OF LIFE**
LESLIE E. ORGEL (Salk Institute for Biological Studies, San Diego, CA) Journal of Theoretical Biology (ISSN 0022-5193), vol. 123, 1986, p. 127-149. NIH-NASA-supported research. refs

The role of RNA catalysis in the origins of life is considered in connection with the discovery of riboszymes, which are RNA molecules that catalyze sequence-specific hydrolysis and transesterification reactions of RNA substrates. Due to this discovery, theories positing protein-free replication as preceding the appearance of the genetic code are more plausible. The scope of RNA catalysis in biology and chemistry is discussed, and it is noted that the development of methods to select (or predict) RNA sequences with preassigned catalytic functions would be a major contribution to the study of life's origins. K.K.

**A87-41440*#** Florida State Univ., Tallahassee.
**MICROBIAL TRACE-FOSSIL FORMATION, BIOGENOUS, AND ABIOTIC WEATHERING IN THE ANTARCTIC COLD DESERT**
E. IMRE FRIEDMANN (Florida State University, Tallahassee) and REBECCA WEED (Maine, University, Orono) Science (ISSN 0036-8075), vol. 236, May 8, 1987, p. 703-705. refs
(Contract NSG-7337; NSF DPP-83-14180)

In the Antarctic cold desert (Ross Desert), the survival of the cryptoendolithic microorganisms that colonize the near-surface layer of porous sandstone rocks depends on a precarious equilibrium of biological and geological factors. An unfavorable shift of this equilibrium results in death, and this may be followed by formation of trace fossils that preserve the characteristic iron-leaching pattern caused by microbial activity. Similar microbial trace fossils may exist in the geological record. If life ever arose on early Mars, similar processes may have occurred there and left recognizable traces. Author

### Typical Subject Index Listing

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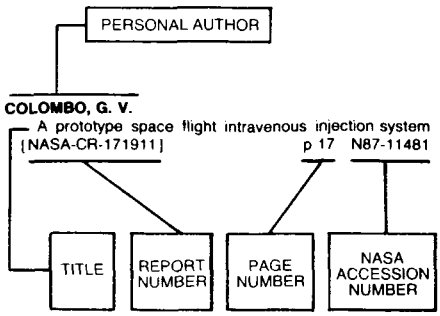


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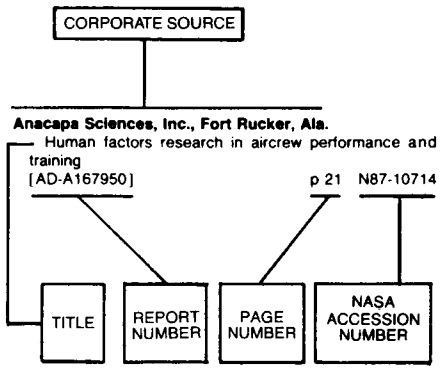


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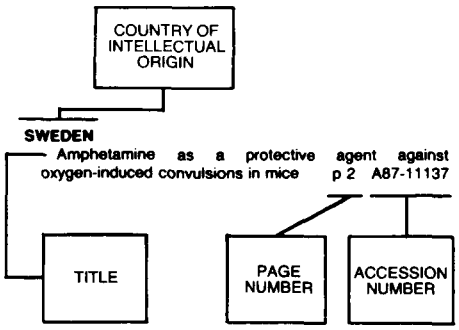


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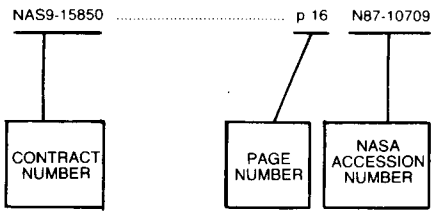


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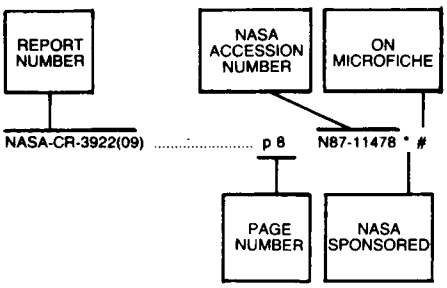


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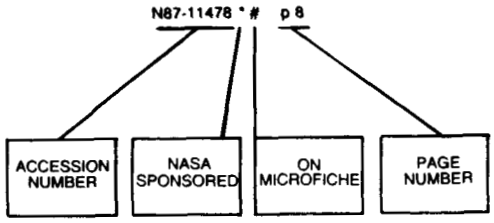


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